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OCS Report
MMS 86-0020

**Offshore Environmental
Studies Program**

Environmental Studies Index

(Atlantic Outer Continental Shelf,
1986)

MMS
U.S. Department of the Interior
Minerals Management Service
Atlantic OCS Region

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Offshore Environmental
Studies Program

OCS Report
MMS 86-0020

Environmental Studies Index

(Atlantic Outer Continental Shelf, 1986)

U.S. Department of the Interior
Minerals Management Service
Atlantic OCS Region

Vienna, Virginia
1986

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Introduction

The Environmental Studies Program of the U.S. Department of the Interior was developed as a response to statutory imperatives. The statutory authorization is derived primarily from three laws: the 1953 Outer Continental Shelf Lands Act, the 1969 National Environmental Policy Act (NEPA), and the 1978 Outer Continental Shelf Lands Act Amendments. The 1953 Act authorizes the Secretary of the Interior to lease the outer continental shelf (OCS) seabed for mineral development. Additionally, Section 5(a) grants permissive authority to the Secretary to develop and implement regulations "necessary and proper in order to provide for the prevention of waste and conservation of the natural resources of the outer continental shelf." In NEPA, Congress declares a national policy to use "all practical means and measures...to create and maintain conditions under which man and nature can exist in productive harmony." Pursuant to this policy, Congress directed all Federal Agencies to integrate natural and social science disciplines into environmental planning and decisionmaking. The OCS Lands Act Amendments direct the Secretary to conduct studies in areas or regions of lease sales to ascertain the "environmental impacts on the human, marine and coastal environments of the outer continental shelf and the coastal areas which may be affected by oil and gas development" (43 U.S.C. -1346).

The Environmental Studies Program began in 1973 under the Bureau of Land Management (BLM). In May 1982, this program along with all leasing and resource management functions of the OCS were consolidated and placed within the Minerals Management Service (MMS). OCS functions within the MMS are divided into four regions: Alaska, Atlantic, Gulf of Mexico, and Pacific. In the Atlantic Region, three planning areas exist: North Atlantic, Mid-Atlantic, and South Atlantic (Figs. 1-3). The Environmental Studies Section for the Atlantic Region develops proposed study programs issued as Regional Studies Plans for each fiscal year. These study plans outline proposed research programs which are intended to provide information on the ways and extent that OCS development could potentially affect the natural environment of the U.S. Atlantic coastal, shelf, slope, and rise regions and also determine effects on human activities in the area. Approved studies are funded in the form of contracts awarded to a variety of qualified research groups. Past and ongoing contracts have produced numerous technical reports, maps, data banks, and other products for use in the planning and management of OCS activities.

The following document is a summary of environmental studies that have been produced for the Department of the Interior in the Atlantic Region. Many of these studies are specific to one or more Atlantic planning areas (North, Middle, South) while some are "national studies," with results applicable to all OCS Regions. For most studies, a limited number of final reports are produced directly for the MMS. This initial supply of reports is distributed in response to requests from interested parties. In addition, most reports can be purchased from the National Technical Information Service (NTIS), (see address listed on next page). One copy of each report is available for review at the MMS Atlantic Region Office in Vienna, Virginia (see address on next page).

National Technical Information Service (NTIS)
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22151

United States Department of the Interior
Minerals Management Service
Atlantic OCS Region
1951 Kidwell Drive
Vienna, VA 22180

Study Abstracts

Following are abstracts for all Atlantic Region studies which have produced or will produce final reports. Each study is issued as a contract or an interagency agreement (IA). Contracts/IA's issued under the BLM are identified by a 5-character prefix (e.g., AA550), followed by the type of study (MOU) Memorandum of Understanding or IA for interagency agreements, CT for contract) and fiscal year awarded (e.g., 6=1976, 0=1980, 2=1982). The final number indicates the specific contract awarded in a given fiscal year (e.g., CT8-46 is the 46th contract awarded in FY 1978). In 1982, all active contracts were placed within the MMS. All MMS contracts have an 8-character prefix (14-12-0001-) followed by a specific identification number (e.g., 30025). Contracts awarded under the BLM and still active in May 1982 have dual designations (e.g., CT1-39/29188). For convenience, the prefix codes are not repeated when studies are referred to in this summary.

Each study abstract lists useful information in a standard format of up to 16 headings.

TITLE: Lists the initial contract or program title. This often differs from the final report title.

DATE: Lists the date of contract award and close-out.

COST: Lists actual cost of the contract.

PRIME CONTRACTOR: Lists the name and address of the prime contractor as stated in the contract. IA's will list the Federal Agency.

SUBCONTRACTORS/COOPERATING INSTITUTIONS: List includes official subcontractors for services and/or technical performance, affiliations of consultants, and organizations cooperating in the study without direct payment for services.

CHARTERED RESEARCH VESSELS: Lists vessels subcontracted under the study for field research.

PROGRAM MANAGER:
Lists the administrative head or principal scientist for the study. Unless otherwise noted, affilation is with the prime contractor.

PRINCIPAL PARTICIPANTS: Lists chief scientists and/or key administrative persons conducting the study. For larger, complex studies this list may be restricted to group or section leaders and omit staff scientists.

CONTRACTING OFFICER: Lists the BLM/MMS officer responsible for administration of the contract. If reassignment occurred during the study a chronological list of contracting officers is presented.

COR: Lists the BLM/MMS Contracting Officer's Representative responsible for technical monitoring of the study. Where applicable, a chronological list is given.

OBJECTIVES: Lists study objectives stated at contract award. Additional objectives added through modification of the contract are noted. These objectives are initial program goals which may or may not be reflected in actual study results.

FINAL REPORT: Lists the title of the official contract final report(s) submitted to the BLM/MMS followed by the authors and year.

AVAILABILITY: Lists the NTIS reference number for the final report or notes special cases.

SUMMARY: Lists major findings of original research or the major contents of literature compilation efforts.

OTHER PUBLICATIONS/REPORTS: Lists publications and related reports making use of study data. These often represent individual efforts of the authors to further elaborate on results obtained under the BLM/MMS contract.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM: Individual contracts often represent 1-year efforts or a specific technical task within a broader program (e.g., South Atlantic Geological Studies, Georges Bank Monitoring Program). For these cases all related contracts are listed at the end of the abstract.

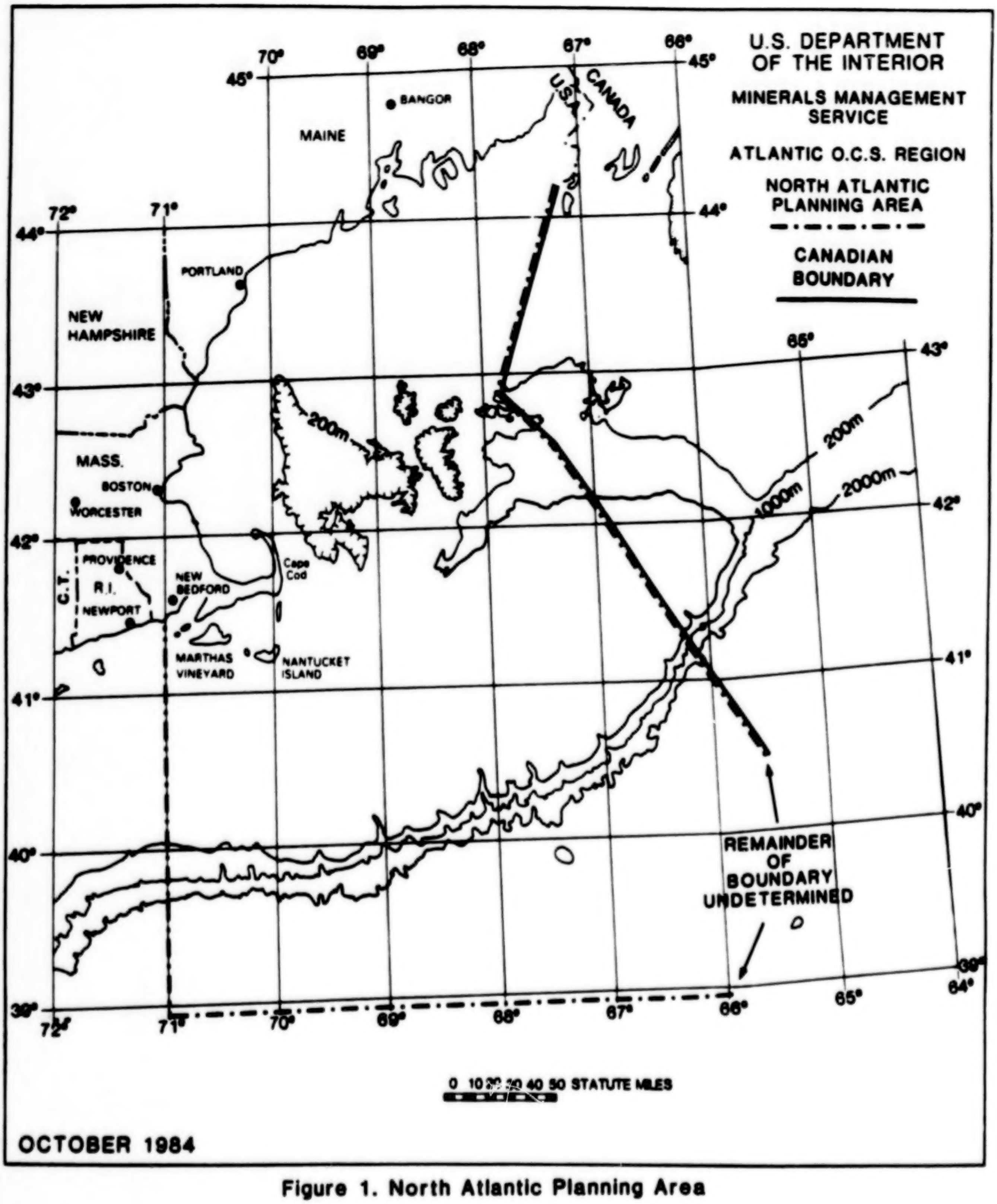

Figure 1. North Atlantic Planning Area

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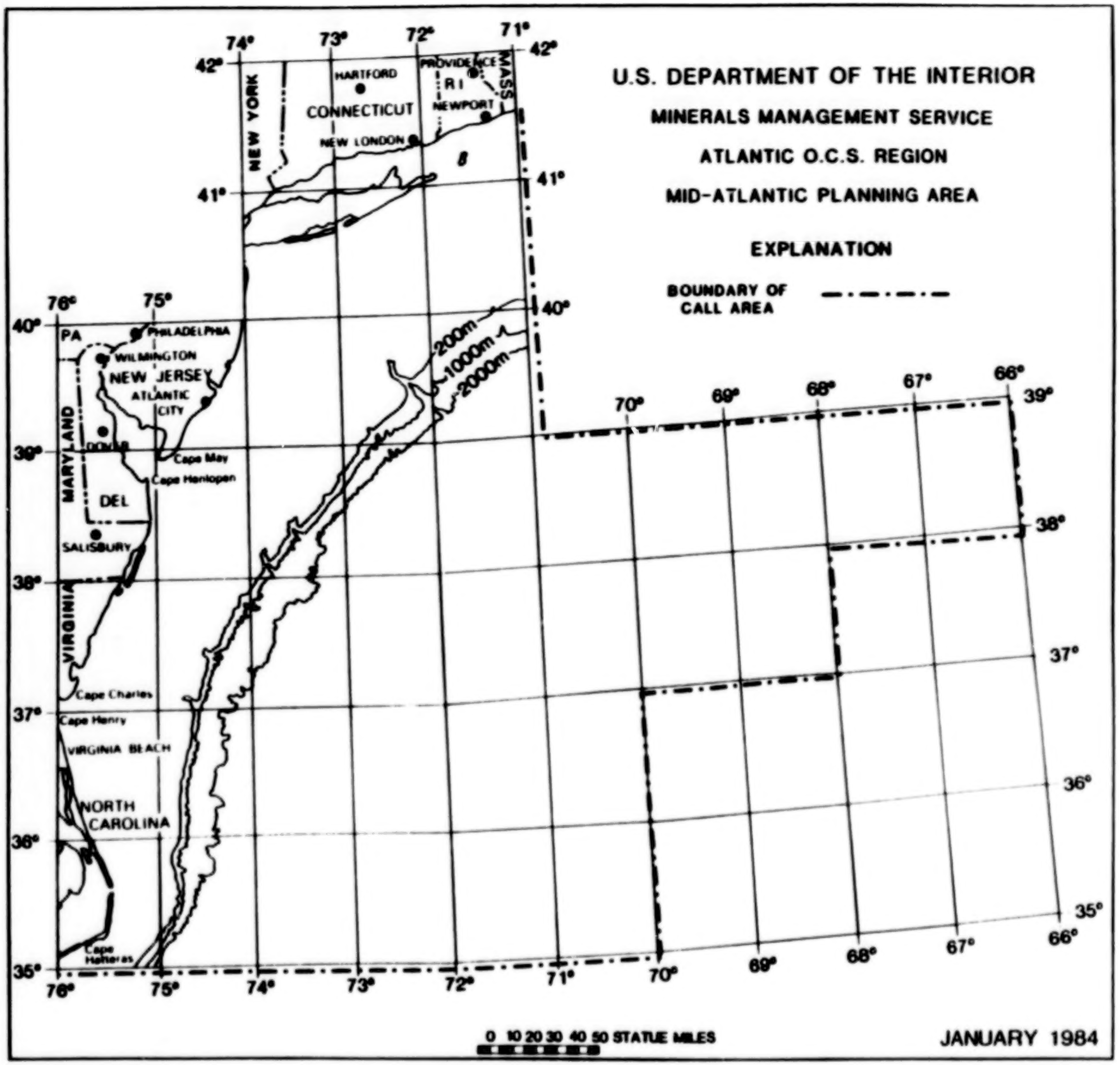

Figure 2. Mid-Atlantic Planning Area

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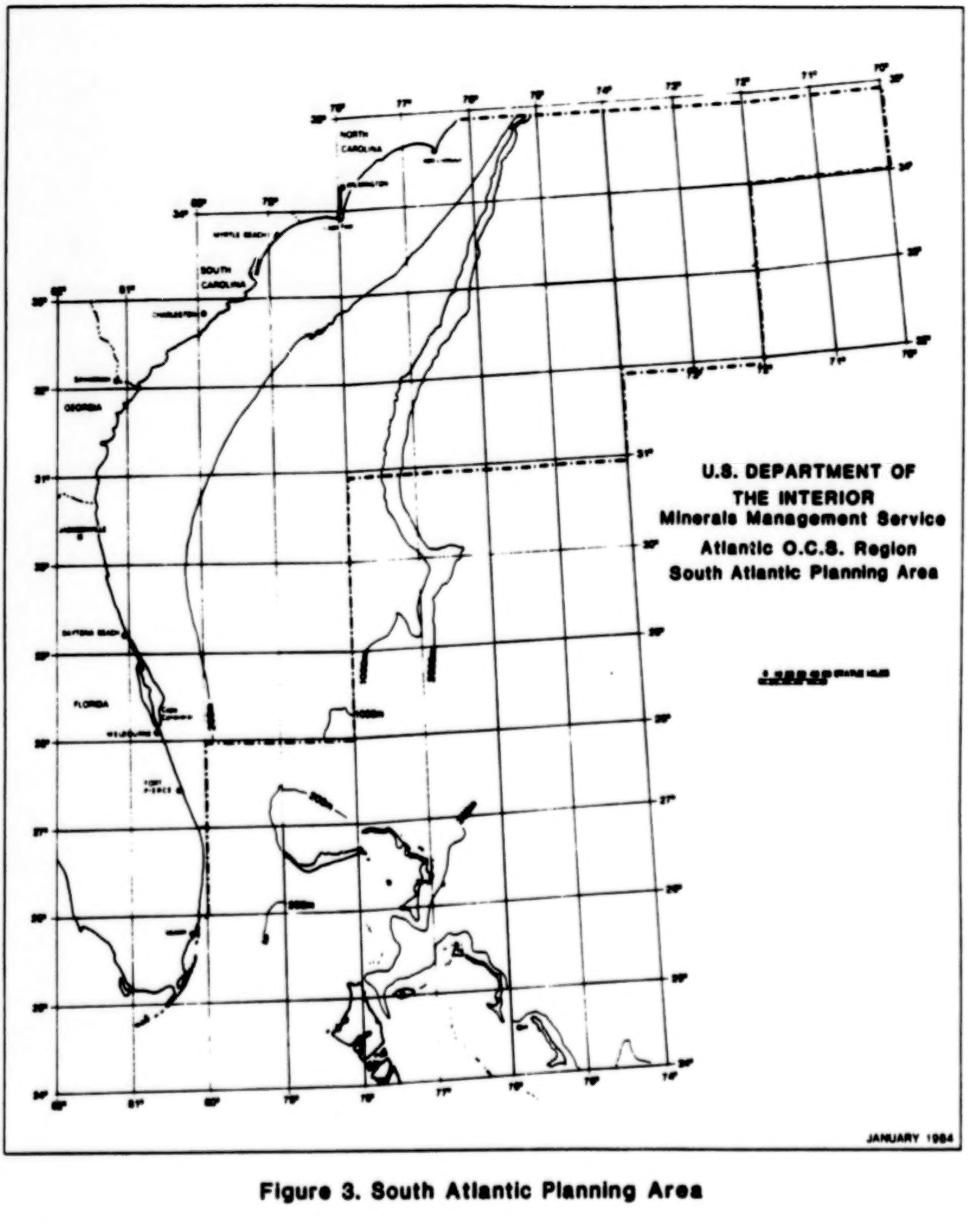

Figure 3. South Atlantic Planning Area

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NORTH ATLANTIC

Conferences and Workshops

BLM CONTRACT NO. 08550-CT5-29

TITLE: Public Conference and Workshop on Georges Bank

DATE: 21 April 1975 - 22 May 1975

COST: $19,770

PRIME CONTRACTOR:
New England Natural Resources Center (NENRC)
506 Statler Building
Boston, Massachusetts 02116

PROGRAM MANAGER:
Charles H. Foster (Conference Chairman)

CONTRACTING OFFICER:
Vernon F. Ehlerding

COR: Frank Basile

OBJECTIVES:

1. Provide a summary of available related information and understanding for a portion of the continental shelf as designated by the Minerals Management Service (MMS) in the Atlantic Region.

2. Provide any predictions presently possible of the effects of drilling (including both exploration and exploitation) on the environment of this area.

3. Identify the areas of knowledge in which additional information is essential for reasonable prediction and understanding of the environmental effects of drilling in this area.

4. Formulate recommendations for baseline and monitoring programs adequate for determination of the environmental effects of any oil and gas exploration and exploitation in this area.

FINAL REPORT:
Georges Bank Conference, Marine Environmental Assessment Needs on the Georges Bank related to Petroleum Exploration and Development (NENRC, 1975)

AVAILABILITY:
A review copy is available at the Minerals Management Service, Vienna, Virginia.

SUMMARY:

The Georges Bank Conference was convened to identify marine environmental assessment needs related to petroleum exploration and development. The Conference broke into four workshop groups (Biological Oceanography, Chemical Oceanography, Geological Oceanography, and Physical Oceanography) to discuss study needs and types of studies needed. The workshop groups then broke into smaller subgroups for more detailed discussions. The major conclusions of the workshop groups and subgroups were presented.

The Biological Oceanography Workshop broke into five subgroups: energy pathways, statistical limits, marine mammals and birds, effects and events, and physiology. The subgroups determined that baseline surveys of the seasonal and geographical distribution of primary production and studies of the benthos, zooplankton, neuston and phytoplankton were needed and feasible. The energy pathways subgroup recommended research on the role and fate of hydrocarbons in the environment. The statistical limits subgroup determined that before the needed survey of the nekton was conducted an acceptable survey technique would have to be developed. The marine mammals and birds subgroup concluded that there was a lack of databases, including life histories, for many species. The effects and events subgroup recommended a survey of fauna, physiological and behavioral studies, and monitoring to detect changes in trophic relationships. The physiology subgroup recommended that the species selected for study be economically important, abundant, amenable to live study in the laboratory, sensitive to pollution, and representative of different modes of living, eating, and of wide-spread distribution.

The Chemical Oceanography Workshop was broken into three subgroups: biochemical pathways, petroleum components, and trace metals. The biochemical pathways subgroup decided that definitions of biologically significant events and the primary nutrient cycle need to be developed and the modifications of biological processes due to oil expoloration need to be evaluated. The petroleum components subgroup concluded that before the needed baseline study can be conducted an analytical methodology needed to be developed to determine the concentration, composition and location of petroleum components in the environment. The trace metals subgroup determined that baseline metal concentrations needed to be determined and that the data should be directly pertinent in terms of possible biological impact.

The Geological Oceanography Workshop was divided into three subgroups: sediment transport, seismic risk, and engineering properties of shallow sediments. The sediment transport subgroup recommended baseline studies of bottom sediment properties, of particulate flux, and of shoal and nonshoal areas to determine particle movement. The seismic risk subgroup identified the need to determine the present seismic activity and to correlate this current activity with tectonic structures. The engineering properties subgroup suggested a regional reconnaissance of geologic engineering properties to evaluate possible hazards.

The Physical Oceanography Workshop was broken into four subgroups: transport, coastal climatology, vertical mixing, and water mass characteristics and distribution. This workshop group identified the need to resolve the routes, reactions, and rates involved in the passage of contaminants or pollutants through the Georges Bank region and the reservoirs in which they may be found.

The conference concluded that a baseline environmental assessment program was needed. Numerous subgroup members pointed to the fact that research vessel time should be shared and multi-interest cruises undertaken. The need for a program manager who would coordinate all efforts was identified.

NORTH ATLANTIC

Environmental Inventories and Assessments

BLM CONTRACT NO. 08550-CT5-47

TITLE: Inventory of Environmental Parameters of the Deep Atlantic Shelf and Slope from the Canadian/U.S. Border to Cape Hatteras, North Carolina.

DATE: 24 June 1975 - 17 January 1977

COST: $48,311

PRIME CONTRACTOR:

The Research Institute of the Gulf of Maine (TRIGOM)
P.O. Box 2320
South Portland, Maine 04106

SUBCONTRACTOR/COOPERATING INSTITUTIONS:

Maine Department of Natural Resources (MDNR)
New England Aquarium (NEA)
Public Affairs Research Center (PARC)
Westinghouse Oceanic Division (WOD)
College of the Atlantic (CATL)
University of Connecticut (U Conn)
University of New Hampshire (UNH)
University of Rhode Island (URI)
Woods Hole Oceanographic Institution (WHOI)

PROGRAM MANAGER:

Stanley Chenoweth, Edward H. Shenton

PRINCIPAL PARTICIPANTS:

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Frank Heppner (URI)
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John Milliman (WHOI)
Hugh Mulligan (UNH)
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Redwood Wright (WHOI)
Barbara Welsh (U Conn)
Carl E. Veazie (PARC)
Gerald R. Visguillio (U Conn/PARC)

CONTRACTING OFFICER:

J. A. Rourke, William E. Hamm, Fred Galinsky, Jeffrey Petrino

COR: Eiji Imamura

OBJECTIVES:

The contractor was to conduct a comprehensive literature search of published and unpublished information, current research, and impending environmental programs relating to the North and Mid-Atlantic Continental Slope, specifically the area between the 200-meter and 2,000-meter isobaths and the limits defined by the Canadian/United States border and Cape Hatteras, North Carolina.

The objectives of this study were to enable the Minerals Management Service to:

1. Compile information for the preparation of Environmental Impact Statements.
2. Provide a data base for the preparation of Environmental Study Plans.
3. Develop a comprehensive inventory of marine environmental information for decisionmaking purposes.
4. Identify gaps and deficiencies in the data base where further data gathering or research is required.

FINAL REPORT:
Summary of Environmental Information on the Continental Slope from the Canadian/U.S. Border to Cape Hatteras, N.C. (TRIGOM, 1976).

AVAILABILITY: Available from the NTIS:
Final Report (Vol. I, Physical, Chemical & Geological Oceanography) - PB284001
Final Report (Vol. II, Biological Oceanography) - PB284002
Final Report (Vol. III, Human Influence) - PB284003
Appendices (Vol. IV) - PN2840004

SUMMARY:

The results of an environmental survey of the Mid-Atlantic and North Atlantic regions of the outer continental slope are described. This region is the area extending from Cape Hatteras, N.C. to the U.S./Canadian border and from the 200-to 2000-meter depth contours; however, many topic areas include information from the continental shelf break to the Gulf Stream. The continental slope is a complex feature representing the transition between two principal levels of the earth's surface, the low density rocks of the continent and the high density rocks of the ocean floor. In the northwest Atlantic, the slope width averages 100 km (62 mi). This relatively narrow band of ocean is a region of change. The geologic structure is a transitional one. The physical and chemical characteristics of the water are highly variable, reflecting the mixing between several major water masses: the coastal waters, Gulf Stream, Labrador Current and Western Boundary Undercurrent. The flora and fauna of the study region are highly diverse, representing a change between the shallow boreal shelf biota and the tropical and warm, temperate oceanic biota in the pelagic realm; and between the abundant, adaptive fauna of the shelf floor and the sparse, conservative fauna of the deep ocean floor in the benthic realm.

BLM CONTRACT NO. AA550-CT6-45

TITLE: A Summary and Analysis of Environmental Information on the Continental Shelf from the Bay of Fundy to Cape Hatteras.

DATE: 29 September 1976 - December 1977

COST: $194,180

PRIME CONTRACTOR:
Center for Natural Areas
Box 98
South Gardiner, Maine 24359

PROGRAM MANAGER:
Edward H. Shenton
William Reed

PRINCIPAL PARTICIPANTS (contributing authors & CNA staff):
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George Keller
David Kirchman
Peter Lawson
J. J. McCarthy
Guy McLeod
Sam Petrocelli
Patricia Ryan
Thomas Sleeter
William Steiner
Roy Stever
Stephen Tibbetts
Barry Timson
Gerald Topinka
Howard Winn
Clarice Yentsch

CONTRACTING OFFICER:
Fred M. Galinsky
Paul Lubetkin

COR: Arthur Howowitz
Phil Thomas

OBJECTIVES:

The Contractor shall furnish the necessary personnel, services, materials and facilities to accomplish a summary and analysis of environmental information for the geographical areas from the Bay of Fundy to Cape Hatteras (figure 4), North Carolina, from the spring tide mark to the 200-m isobath. Literature dating from the beginning of 1973 shall be examined for the Region from the Bay of Fundy to Sandy Hook, New Jersey, and from the beginning of 1972 for the Region from Sandy Hook, New Jersey, to Cape Hatteras, North Carolina. The results from this effort will emphasize data compilation, integration, analysis, and interpretation. The basic study objectives are to:

1. Provide published and unpublished materials, as well as data sources, which update marine environmental information presented

in the documents produced by The Research Institute of the Gulf of Maine (TRIGOM) (1974) and University of Rhode Island (1972-1973).

2. Compile and integrate both laboratory and field data concerning the effects of petroleum hydrocarbons and trace metals on marine organisms.
3. Summarize and document ongoing oceanographic survey and research programs.
4. Compile sources of raw data and unanalyzed samples.
5. Identify data gaps in each topic area and recommend future studies to fill the gaps.

FINAL REPORT:

A Summary and Analysis of Environmental Information on the Continental Shelf from Bay of Fundy to Cape Hatteras (CNA, 1977).

AVAILABILITY:

Available from NTIS:

Final Report (Vol. I, Bk. 1, Geology, Meteorology, Physical Oceanography, Chemistry) - PB80177462
Final Report (Vol. I, Bk. 2, Neuston, Nekton, Benthos, Fisheries, Marine Mammals) - PB80177470
Final Report (Vol. I, Bk. 3, Birds, Endangered Species, Microbiology, OCS Uses) - PB80177488
Final Report (Vol. II, Master Bibliography, Index, Acknowledgements) - PB80177496
Appendices (Vol. III) - PB80177504

SUMMARY:

The final report was three volumes. Volume I consisted of 3 books with a total of twenty chapters. Each chapter dealt with an environmental topic consisting of a statement of data sources, data gaps, and recommended future studies. Recommendations for future studies were based on an assessment of available data and resulting data gaps.

In geology, there was a lack of information about the specific sediment supply budget of beach compartments, a lack of data concerning the general structural and stratigraphic configuration of the marine environment and a lack of data concerning sedimentary processes in the marine environment. Studies were recommended to fill these gaps and also gaps concerning beach systems, barrier island maintenance, and flood tidal deltas.

Meteorological studies should be aimed at constructing a vertical profile of wind and temperature, and studies of the sequence and duration of events. Physical oceanography studies should determine the driving mechanism of the counterclockwise and clockwise gyres.

Studies of the effects of oil and PCB levels on phytoplankton species were recommended. Zooplankton studies of the nutrition and metabolism of various species and their seasonal and areal distribution were recommended.

Studies of the neuston should include studies of the microorganisms present in the microlayers. Recommended studies of the nekton included collection of basic life history information for most fish species, determination of the relationship between species and the ecosystem, and standardizing procedures so that data from different studies would be comparable.

Recommended studies of commercial fisheries included the collection and processing of statistical information, analysis of socioeconomic data, and development of an adequate stock assessment technology. In sport fisheries, recommended studies included collection of statistical data and assessment of man's impact on resources.

Recommended studies of the benthos included studies of the dominance and distribution of organisms and collection of life history data. Recommended benthic flora studies included seasonal and long term studies of rocky shore algal communities and salt marsh flora.

Recommended marine mammal studies included a census of all species, diet studies, assessment of the ecological relationships, and determination of the areal and seasonal distribution of species.

Studies of marine birds were recommended including studies of the distribution of pelagic seabird species, the ecology of seabirds and the relationship between seabirds and man made structures.

Recommended endangered species studies included identification and determination of numbers and distribution of species, coordination and summarization of all data, and determination of the range and requirements of species.

Recommended toxicity and health studies included studies of bioaccumulation, acute toxicity, and sublethal effects.

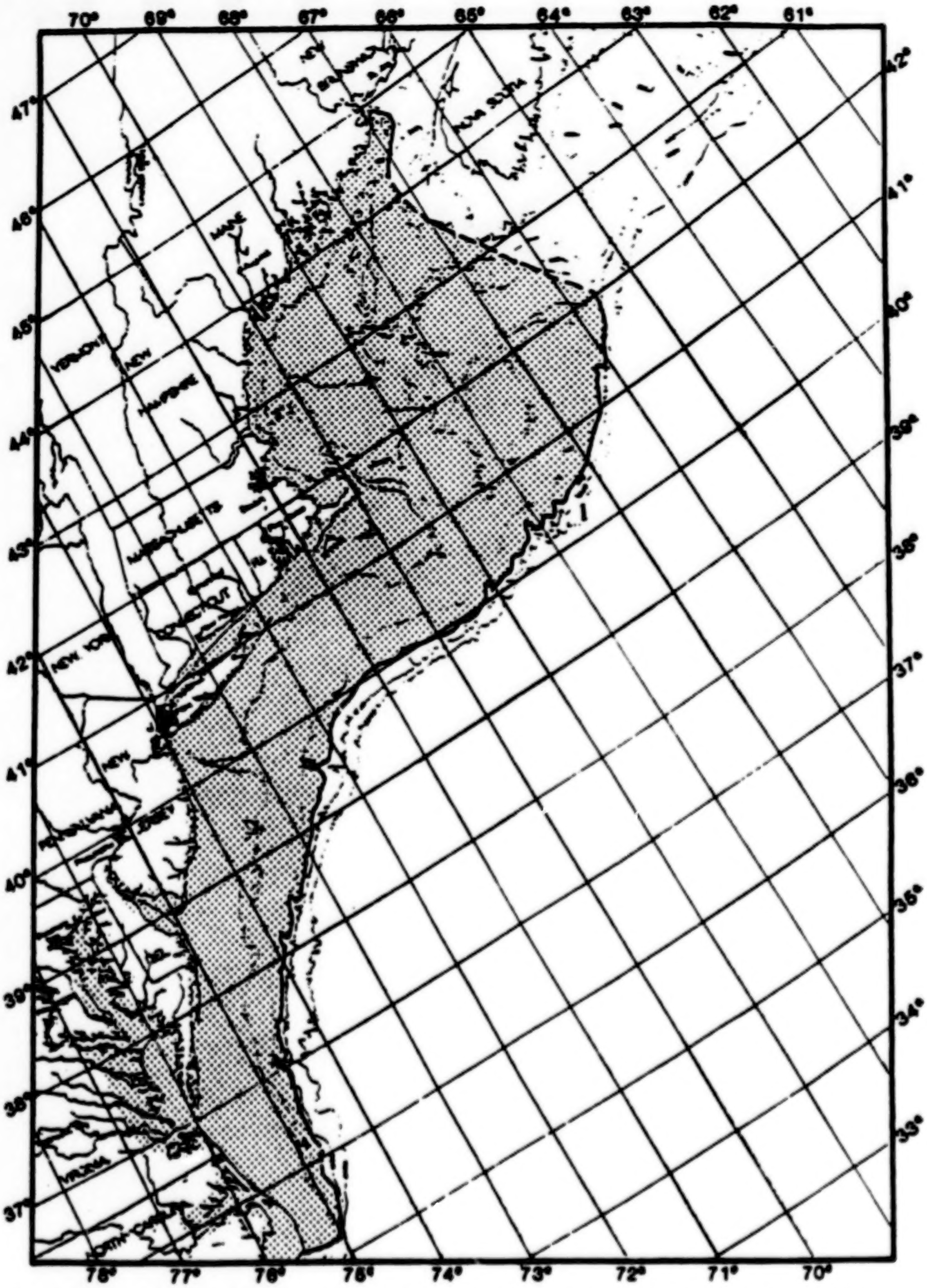

Figure 4. Location of the study area for "A Summary and Analysis of Environmental Information on the Continental Shelf from the Bay of Fundy to Cape Hatteras", BLM Contract No. AA550-CT6-45.

BLM CONTRACT NO. AA550-CT6-51

TITLE: New England Outer Continental Shelf Environmental Benchmark Study

DATE: 19 August 1976 - 15 May 1978
(Terminated prior to completion of all tasks)

COST: $4,302,416

PRIME CONTRACTOR:
Energy Resources Company, Inc. (ERCO)
185 Alewife Brook Parkway
Cambridge, Massachusetts 02138

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Battelle New England Marine Research Laboratories (BNEMRL)
Bigelow Laboratory (BL)
Laboratory Services Associates
Marine Research, Inc. (MRI)
Massachusetts Institute of Technology (MIT)
University of Delaware (UD)
University of Maine (UM)

CHARTERED RESEARCH VESSELS:
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R/V *Gyre*
R/V *Knorr*

PROGRAM MANAGER:
Richard Rosen
Joel E. Alpert

PRINCIPAL PARTICIPANTS:
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Jeffrey Tinsman (UD)
Richard Toner (MRI)
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Leslie Watling (UM)
Chris Wethe (UD)

CONTRACTING OFFICER:
William Hamm
Jeffrey P. Petrino

COR: Kenneth Berger
Eiji Imamura

OBJECTIVES:

The long-range objectives of the study were to:

1. Determine the ranges of high molecular weight (HMW) hydrocarbons and selected trace metal concentrations in the sediments and selected macrofauna species preceding oil and gas development as a baseline against which possible man-induced chemical change can be assessed in the future.

2. Delimit the major chemotopes, lithotopes, and biotopes for the study area, and characterize each with respect to natural seasonal variability and inter-relationships.

3. Characterize the existing health of selected benthic macrofauna preceding oil and gas development, and establish a histological data base that could serve as a reference for later comparisons.

4. Describe dominant microbes in sediments and in the upper water layers and evaluate their potential and possible importance in the degradation of oil.

5. Describe the HMW hydrocarbon and selected trace metal concentrations in the water column.

6. Identify and describe unique or fragile endangered areas.

7. Collect other data supportive of the above objectives.

FINAL REPORT:

New England OCS Environmental Benchmark Draft Final Report (ERCO, 1978)

AVAILABILITY:

Available from NTIS:
Final Report (Vol. I) - PB81174906
Final Report (Vol. II) - PB81174914
Appendix (Vol. III) - Review copy available at Minerals Management Service, Vienna, Virginia 22180
Appendix (Vol. IV) - PB81174922
Appendix (Vol. V) - PB81186785

SUMMARY:

The Draft Final Report presents the initial findings of the first year's sampling efforts of the North Atlantic Outer Continental Shelf (OCS) program. Individual results are indicated in Volumes I and II. Appendices are listed in Volumes III, IV, and V.

OTHER PUBLICATIONS/REPORTS:

Boehm, P. D., W. G. Steinhauer, D. L. Fiest, N. Mosesman, J. F. Barak, and G. H. Perry. 1979. A chemical assessment of the present levels and sources of hydrocarbon pollutants in the Georges Bank region. In Proceedings 1979 Oil Spill Conference, pp. 333-341.

Larsen, P. F. and R. M. Lee, 1978. Observations on the abundance, distribution and growth of postlarval sea scallops, Placopecten magellanicus, on Georges Bank. The Nautilus 92:112-116.

Maurer, D. and W. Leathem, 1980. Ecological distribution of polychaetous annelids of Georges Bank. College of Marine Studies, University of Delaware, CMS-1-80, 181pp.

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NORTH ATLANTIC

Socio-Economic Studies

BLM CONTRACT NO. 08550-CT3-08

TITLE: Socioeconomic and Environmental Inventory of the North Atlantic Region from Sandy Hook, New Jersey, to the Bay of Fundy

PRIME CONTRACTOR:

The Research Institute of the Gulf of Maine (TRIGOM)
P.O Box 2320
South Portland, Maine 04106

OBJECTIVES:

1. Develop a comprehensive inventory of marine environmental data for the coastal zone and adjacent waters of the outer continental shelf.

2. Conduct a study of the socioeconomic factors operating in the region from the Bay of Fundy (Eastport, Maine) to Sandy Hook, New Jersey.

3. Combine these previous steps into a comprehensive compilation for use in preparing impact assessments of the development of offshore energy resources.

4. Define the gaps and deficiencies that exist in the present information baseline as preliminary to conducting new research field surveys.

A secondary set of objectives which altered the scope of work and made major demands on the project was added just prior to contract negotiation. This addition was requested to meet the requirements of the Council on Environmental Quality (CEQ), which included:

5. Provide general biological habitat descriptions for the two biogeographical regions, including key species for each one.

6. Map the areal extent of these habitats.

7. Provide specific lists of life history data for all key species.

FINAL REPORT:

A Socioeconomic and Environmental Inventory of the North Atlantic Region from Sandy Hook, New Jersey, to the Bay of Fundy (TRIGOM, 1974)

AVAILABILITY:

A review copy is available at the Minerals Management Service, Vienna, Virginia 22180.
Final Report (Vol. I, 5 Bks, Environmental Inventory)
Final Report (Vol II, Socioeconomic Inventory)
Appendices (Vol. III, 2 Bks.)

SUMMARY:

The study is a compilation of literature pertaining to the North Atlantic region, between New Jersey and Canada. Specific topics include environmental issues; geological, physical, and chemical oceanography; meteorology; hydrology; systems ecology (phytoplankton, zooplankton, benthic invertebrates, macrophytes, fishes, birds, mammals); unique and endangered environments; environmental quality; and socioeconomic topics including demography, recreation, transportation, fisheries, and canal and water use. The following is a list of data gaps and data needs identified in the study:

- more complete and sophisticated geophysical data
- physical controls upon shelf processes
- sediment movement and man's impact on sediment movement
- geologic processes of small beaches and larger strands
- oil pollution of beaches
- flushing rates for estuaries
- measurement of temperature, salinity, and currents
- nutrient concentrations
- suspended matter data
- trace metal and hydrocarbon fates and concentrations
- offshore continuous meteorological observations
- phytoplankton dynamics
- zooplankton abundance and distribution
- benthic invertebrate abundance and distribution
- fish zoogeography, reproduction, feeding, and life history
- baseline bird population studies
- marine mammal abundance and distribution.

BLM CONTRACT NO. CT6-25 & CT6-26 (continuation)

TITLE: Socioeconomic Model Run

DATE: April 1976 - September 1976

COST: $26,120

PRIME CONTRACTOR:

International Research and Technology Corporation (IRT)
McLean, Virginia 22102

OBJECTIVE:

The objective of these studies was to determine the onshore environmental impacts of changes in economic activity resulting from offshore oil development on the New England coast, and in the Mid-Atlantic.

FINAL REPORT:

Environmental Consequences of Onshore Economic Activity Resulting from Offshore Oil and Gas Development in New England (M. Narkus-Kramer, A. Watson; 1976)

AVAILABILITY:

A review copy is available at the Minerals Management Service, Vienna, Virginia, 22180

SUMMARY:

Air pollution emissions are expected to increase as a result of industrial and consumer activity related to the development of offshore oil and gas in New England. These increases are projected to present a serious air emissions problem for Union, New Jersey, and Middlesex, New Jersey, for one of the scenarios analyzed. These increases can be traced almost entirely to the added refinery activity which results from the processing of New England oil. SO_x emission from natural gas processing plants could present a serious environmental hazard to the New England counties analyzed if stringent controls are not required. With stringent controls, the SO_x emissions increases are tolerable. No other increases in air pollution for the counties analyzed are significant.

Onshore pollution increases resulting from oil and gas development were determined to be insignificant for all the counties analyzed. Non-point water pollution sources, such as potential run-off from construction, was not analyzed in this report and could be important. Further investigation of non-point water pollution impacts should be pursued.

FINAL REPORT:

Environmental Consequences of Onshore Activity Resulting from Offshore Oil and Gas Development in the Mid-Atlantic (A. Watson, M. O'Farrell; 1978)

AVAILABILITY:

A review copy is available at the Minerals Management Service,
Vienna, Virginia 22180

SUMMARY:

In this report, an assessment is made of the environmental impact of onshore economic activity resulting from potential offshore oil and gas development from Sale No. 49 (second sale in the Mid-Atlantic). The analysis is based on four hypothetical scenarios for several coastal counties, and the results are reported on a county basis. This final report is in draft form, a final version is unavailable.

BLM CONTRACT NO. AA551-CT8-18

TITLE: Summary and Analysis of Cultural Resource Information on the Continental Shelf from the Bay of Fundy to Cape Hatteras

DATE: 23 May 1978 - December 1979

COST: $235,555

PRIME CONTRACTOR:

Harvard College (Peabody Museum, Institute of Conservation Archaeology)
Holyoke Center
1350 Massachusetts Avenue
Cambridge, MA 02138

PROGRAM MANAGER:

Michael Roberts

PRINCIPAL PARTICIPANTS:

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Laurel Casjens
Randal Moir
John E. Rempelakis

CONTRACTING OFFICER:

Anthony F. Guida
Francis F. Sullivan

COR: Arthur J. Horowitz
Philip Thomas

OBJECTIVES:

An evaluation of the potential cultural resources on the submerged federally controlled lands of the North and Mid-Atlantic Outer Continental Shelf (OCS) is necessary as a rational framework on which to base management decisions concerning OCS development. The objectives of this study were to:

1. Review late Quaternary geology of the areas as it relates to cultural resources.
2. Assess and identify those cultural resources located to date.
3. Determine the probabilities of resource occurrence by area and/or feature.
4. Identify potential pilot study area(s).

5. Review present study techniques and recommend possible modification of search and recovery techniques.

6. Identify significant data gaps.

FINAL REPORT:

A Summary and Analysis of Cultural Resource Information on the Continental Shelf from the Bay of Fundy to Cape Hatteras (R. Moir, R. Barber, B. Bourque, M. E. Roberts; 1979)

AVAILABILITY:

Available from NTIS: Set - PB80220106
Final Report (Vol. I, Physical Environment) - PB80220114
Final Report (Vol. II, Archaeology & Paleontology) - PB80220122
Final Report (Vol. III, Historic Shipping)- PB80220130
Final Report (Vol. IV, Management) - PB80220148

SUMMARY:

Models of human settlement on the continental shelf were derived by two methods. First, data were assembled on archaelogical sites known from areas contiguous to the project area which have not been inundated by rising sea levels. Using these data, patterns of settlement were derived for different periods, site types, and portions of the project area. These patterns, it is argued, can be extended to portions of the project area. Optimal foraging theory, a body of ecological theory concerned with the patterns of subsistence followed by populations in different types of environments, was also applied. Second, using the reconstruction of environment, models of human settlement in different zones were developed. These two models were combined to form a final model of settlement pattern believed to be the best approximation possible. The final model discussed expected site type, location, size, frequency, and special characteristics and has been translated into graphic form on maps. In buried river valleys close to 100 percent preservation is expected, while on the valley slopes closer to 40 percent preservation is expected.

An inventory of approximately 2,000 wrecked ships was compiled in the course of developing models for the distribution of historical ship wrecks. The analysis of the history of shipping, population growth, and published sources of wreck location, made it possible to predict the locations of wrecked ships of various time periods. The predictions were derived from the integration of information on known shipping lanes, expected number of ships of any one period, hazards to navigation, and other elements. As a result of this analysis, it was determined that the 5-fathom and 10-fathom depths are critical boundaries for predicting historic shipping wreck sites. In this context, ships from the pre-1880 era can be expected to cluster within the 5-fathom line while ships earlier than 1945 can be expected to be distributed inside the 10-fathom line. Vessel remains were also expected to cluster near and in major harbors of the time, such as Boston, New York, Philadelphia, and Hampton and in shallow-water areas near major sea lanes such as Nantucket Shoals, Cape Cod, and Cape Hatteras.

BLM CONTRACT NO. AA851-CT0-75/MMS CONTRACT NO. 14-12-0001-29181

TITLE: North Atlantic OCS Area Study of the Economic Cost from Oil Spills to Commercial Fishing

DATE: 30 September 1980 - September 1982

COST: $954,068

PRIME CONTRACTOR:
University of Rhode Island (URI)
Kingston, Rhode Island 02881

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Applied Science Associates, Inc. (ASA)

PROGRAM MANAGER:
Clement Griscom (URI)
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PRINCIPAL PARTICIPANTS:
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Henry A. Walker (URI)
Mark Reed (ASA)

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Eiji Imamura
William H. Lang

OBJECTIVES:

This study was to utilize and further develop the ASA/URI Oil Spill-Fishery Impact Assessment Model System composed of model components for hydrodynamics, oil-spill fate, ichthyoplankton transport and fate, and fishery dynamics to address the following objectives:

1. Quantify the impacts of oil spills on selected candidate fish populations in the North Atlantic.

2. Evaluate the subsequent economic loss from oil spills.

3. Evaluate the precision and sensitivity of the prediction method.

4. Include additional model runs for evaluation of oil-spill trajectories for the Department of State.

FINAL REPORT:

Assessing the Impact of Oil Spills on a Commercial Fishery (University of Rhode Island Applied Science Associates, 1982)

AVAILABILITY:

Available from NTIS: Final Report - PB83149104

SUMMARY:

An oil-spill fishery-impact assessment model system has been applied to the Georges Bank/Gulf of Maine region to assess the probable impact of oil spills on several key fisheries. The model system addresses direct impacts of oil on the commercial fishery through hydrocarbon induced egg and larval mortality. This early life stage hydrocarbon induced mortality is estimated by assuming a toxicity threshold approach and mapping the spatial/temporal interaction between the developing eggs and larvae and the surface and subsurface oil concentrations caused by the spill. Ichthyoplankton losses are interpreted as recruitment reduction in the adult fisheries model. Model system output is given in terms of differential catch, comparing the natural and hydrocarbon impacted fisheries.

Fishery impact estimates have been made for both tanker and oil well blowout scenarios at various locations and times of year. Atlantic cod has been employed as the principal fish species, and Norwegian Stafford crude has been used as the prototypical oil. Impacts on Atlantic herring, haddock, and yellowtail flounder have also been investigated for selected cases. All spill sites are located on Georges Bank with the majority in the region of projected OCS leasing activity.

The results of these simulations suggest a complex interaction among spill location and timing, the spatial and temporal distribution of spawning, the population dynamics of the species under study, and the hydrodynamics of the study area. In general, spills occurring during the winter and spring produced the largest impacts with cod being the most heavily effected species followed by haddock, herring, and finally yellowtail. The maximum cumulative loss to the fishery of a one-time spill event never exceeded 25 percent of the annual cod catch (125 percent for herring), with the exact value depending on the number of ichthyoplankters effected by the spill and the compensatory dynamics of the population.

OTHER PUBLICATIONS/REPORTS:

Anderson, E.L. 1982. Oil spill hindcast simulation of the IXTOC Gulf of Mexico spill. Master's Thesis, Department of Oceanographic Engineering, University of Rhode Island.

Anderson, E.L. 1983. Study of wind and current data sets for IXTOC oil spill hindcast. Proc. 1983 Oil Spill Conference, EPA/API/USGS, J.O. Ludwigson (ed.), pp. 293-299.

Anderson, E.L. and M.L. Spaulding. 1981. Application of an oil spill fates model to environmental management on Georges Bank. Environmental Professional 3:119-132.

Isaji, T. and M.L. Spaulding. 1984. A Model of the Tidally Induced Residual Circulation in the Gulf of Maine and Georges Bank, Journal of Physical Oceanography, 14(6):1119-1126.

Isaji, T., M.L. Spaulding, and M. Reed. 1984. A Numerical Modeling Characterization of the Annual Three Dimensional Circulation in the Georges Bank - Gulf of Maine Region. Journal of Physical Oceanography, (in review).

Isaji, T.M., M.L. Spaulding, and C. Swanson. 1982. A three-dimensional hydrodynamic model of wind and tidally-induced flows on Georges Bank. Appendix A, In Interpretation of the Physical Oceanography of Georges Bank, EG&G Environmental Consultants, Final Report, BLM Contract No. AA835-CT1-39.

Jayko, K.L. 1982. Eigenfunction analysis and prediction of temperature and salinity profiles in the Gulf of Maine/Georges Bank region. Master's Thesis, Department of Ocean Engineering, University of Rhode Island, 184 pp.

Lorda, E. 1983. Stochastic stimulation of the dynamics of fish populations using nonlinear Leslie matri models: Methodology, probablistic analysis, and application to the Georges Bank cod fishery. Ph.D. diss. in biological oceanography University of Rhode Island, Graduate School of Oceanography, Kingston, Rhode Island.

Lorda, E., S.B. Saila, and H.A. Walker. 1984. A stochastic model of the dynamics of age-structured fish populations. Canadian Journal of Fisheries and Aquatic Science (submitted).

Reed, M. and M.L. Spaulding. 1981. A computer model system for marine pollutant impact assessment: Potentials for coastal state use. In Oceans 82 Conference Record, Marine Technology Society, Washington, DC, September 20-22, 1982, pp. 1156-1163.

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Reed, M., M.L. Spaulding, and E.L. Lorda. 1982. Oil spill fishery impact assessment modeling: The fisheries recruitment problem, Georges Bank. Hydrocarbon Exploration and Development Technological Conference, Nantucket Island, Massachusetts, April 27-30, 1982.

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Spaulding, M.L., M. Reed, E. Anderson, T. Isaji, S.B. Saila, E. Lorda, and H. Walker. 1985. Oil spill fishery impact assessment model: Sensitivity to spill location and timing. Estuarine, Coastal and Shelf Science 20:41-53.

Spaulding, M.L., S.B. Saila, E. Lorda, H. Walker, E. Anderson, and J.C. Swanson. Oil spill fishery impact assessment model: application to selected Georges Bank fish species. Estuarine, Coastal and Shelf Science 16:511-541.

Swanson, J.C. A three-dimensional numerical model of hydrodynamics on the continental shelf. Ph.D. dissertation, Department of Ocean Engineering, University of Rhode Island (pending).

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NORTH ATLANTIC

Geology/Chemistry

BLM INTERAGENCY AGREEMENT NO. AA550-MU6-29

TITLE: North Atlantic Geological Studies, Year 1

DATE: 13 October 1976 - 19 May 1980

COST: $946,475

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Energy Resources Company, Inc. (ERCO)
Raytheon Company (RC)
National Oceanic and Atmospheric Administration (NOAA)
EG&G Environmental Consultants (EGG)
Woods Hole Oceanographic Institution (WHOI)

PROGRAM MANAGER:
David W. Folger

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CONTRACTING OFFICER:
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Jeffrey P. Petrino

COR: Eiji Imamura

OBJECTIVES:

1. Measure the rate of sediment mobility over the seabed and monitor resultant changes in bottom morphology and texture.

2. Determine the concentration, distribution, and flux of suspended particulate matter in the water column.

3. Determine the vertical distribution of trace metals in the near-surface sediment at selected locations.

4. Evaluate potential hazards to oil and gas development due to surficial and intermediate depth structure and mass sediment transport events.

5. Support the activities of the prime physical oceanography and chemical/biological benchmark contractors by obtaining supplemental physical oceanographic data by analyzing samples of suspended sediment, and by helping to synthesize and interpret the geological data on physical, biological, or chemical shelf processes.

FINAL REPORT:

Environmental Geologic Studies in the Georges Bank Area, United States Northeastern Atlantic Outer Continental Shelf, 1975-1977 (J. M. Aaron, editor, 1980).

AVAILABILITY:

Available from NTIS: Final Report - PB80177512
Executive Summary - PB80177520

SUMMARY:

Shelf and slope waters off New England show both the highest and lowest seston concentrations off the eastern United States. The highest concentrations (15,000 ug/l) were measured on the shelf south of Nantucket Island during the winter; this is significant because it exceeds the estimated level of suspended material which may cause crude oil to sink to the bottom. The lowest values were found in slope waters at the shelf edge at concentrations of 50 ug/l. The sources of suspended matter are predominately from biological production and to a lesser extent from resuspension of bottom sediment. The relative importance of the two sources varies with seasonal changes in the biological cycle and stability of the water column and with major storms. Increases in lithogenic material were observed during the winter as a result of the decrease in stability and consequent increase in mixing. Two areas of continuously active sediment resuspension were observed in this study: one area in the southwest part of the Gulf of Maine north of the Great South Channel and the second, south of Nantucket Island.

Site analysis of vibracores collected from the North Atlantic Outer Continental Shelf (OCS) areas indicates a predominance of the sand size class at essentially all depths and at all locations. Larger concentrations of silts and clays were evident in samples taken west of the Great South Channel, and more occurrences of gravel were observed to the east. Texture and age suggest that the sediments are Late Wisconsian glacial till. There is a uniform texture to a depth of 20-30 cm; possibly due to effective mixing of the sediments to this depth. The major clay mineral group observed was illite with moderate amounts of chlorite and small amounts of kaolinite; the illite and chlorite are indicative of largely unweathered material that was eroded in Paleozoic and older rocks in the northern Appalachian region. The leachable concentrations of Cr, Cu, and Zn and the total concentrations of Ba, Cd, Cr, Cu, Fe, Ni, Pb, V, and Zn are low and characteristic of an area having uncontaminated coarse-grained sediment. Radiocarbon analyses of organic sediment south of Nantucket Island and east of the "mud patch" center indicate a fairly constant accumulation of fine-grained sediment at an average rate of 36 to 58 cm/1,000 years during the past 10,000 years.

The maximum current speeds and associated bottom sediment movement took place in waters less than 50 m deep on the top of Georges Bank and in the Great South Channel which serves as a conduit for flow from the Gulf of Maine. In these areas stability problems due to scour will be greatest, and excavation problems, where large lag gravel and boulder deposits occur, will be most difficult. Any pollutants introduced into these areas can be distributed rapidly over large distances by the high current speeds and mixed into the mobile substrate. Thus, the rich organic benthic and epibenthic life could be affected over a wide area in a short period of time. Conversely, the widespread mixing of the water column and the sediment movement could also dilute pollutants rapidly, perhaps to levels that would not affect organisms seriously. These problems can only be resolved over a period of time with detailed future observations.

Several potential hazards were identified. Sediment mobility on Georges Bank suggests two kinds of potential hazards: scour around structures and deposition of excessive sediment around supporting structures. The shallow sediments are quite variable; this could lead to differential settling. No shallow faults or slumps were detected in this area of the slope.

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Bothner, M.H., P.P. Johnson, and E.C. Spiker. 1980. Pb-210 in sediment cores from the Atlantic Continental Shelf: Estimates of rates of sediment mixing. 26th International Geological Congress, Abstracts, no. 26, v. 2, p. 440.

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Rendigs, R.R., M.H. Bothner, and L.J. Poppe. 1980. Sediment characteristics of a modern fine-grained deposit on the southeastern New England Continental Shelf (abs.). Geological Society of America, Abstracts with Programs, v. 13, no. 3, p. 171-172.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

MU0-16/29175
MU0-18/29175
IA1-15/29183
IA1-17/29184
IA2-26/29196
CT5-42 & MU5-33
CT6-62 & MU7-31
MU6-56
MU8-13
MU8-21
MU8-24
MU9-04
MU9-08/29166

BLM INTERAGENCY AGREEMENT NO. AA551-MU8-24

TITLE: North Atlantic Geological Studies, Year 2

DATE: 6 July 1978 - 15 May 1979

COST: $999,782

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
NOVA University (NOVAU)
Woods Hole Oceanographic Institution (WHOI)
University of Rhode Island (URI)

PROGRAM MANAGER:
John M. Aaron

PRINCIPAL PARTICIPANTS:
James Booth
Michael Bothner
Bradford Butman
Marlene Noble
Dennis W. O'Leary
Kathyrn Scanlon
David Twichell

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Eiji Imamura

OBJECTIVES:

1. Measure or estimate the rate of sediment mobility over the seabed and monitor the resultant changes in bottom morphology and texture.

2. Assess the seasonal and spatial variability of the major sediment transport mechanisms and characterize the regional bottom circulation patterns.

3. Determine the concentration, distribution, and flux of suspended particulate matter in the water column.

4. Identify and map mass-movement features and investigate the ages, causes, mechanisms, and potential for reactivation or extention.

5. Identify potentially disruptive features in the shallow subsurface section, including faults and bodies of unstable sediment, and assess the potential for failure under natural or engineered stress.

6. Assess geotechnical properties of near-surface sediment in selected tracts.

7. Support the activities of the physical oceanography contractor by obtaining supplemental information and helping to synthesize and interpret data as it pertains to physical oceanographic processes on the shelf.

FINAL REPORT:

Environmental Geologic Studies in the Georges Bank Area,
United States Northeastern Atlantic Continental Margin, 1978-1979
(D. W. O'Leary, editor, 1982)

AVAILABILITY:

Available from NTIS: Final Report and Executive Summary -
PB83144808

SUMMARY:

This study presents the results of research undertaken by the USGS in pursuit of objectives outlined in Memoranda of Understanding (MOU) AA55-MU8-24 and AA551-MU9-04, and also in continuation of those objectives addressed by MOU AA550-MU6-29. The research deals mainly with oceanographic processes and surficial geological conditions on the outer continental shelf (OCS) and continental slope of the North Atlantic region (i.e., Georges Bank and vicinity), specifically in the Lease Sale No. 52 lease area. The study presents data acquired from 16 cruises between 1977 and 1979 as well as the results of the long-term tripod and current meter program begun in 1975 to study sediment transport. The study also includes descriptions of methods, procedures instrumentation, and analytical results. The analytical results and the cruise reports for each of the sampling and seismic cruises are tabulated in appendices. Original data, including seismic records and trackline charts, are on file with the USGS in Woods Hole, Massachusetts.

A clockwise circulation around Georges Bank was measured by means of moored current meters, aircraft-tracked surface drifters, and satellite-tracked drifters drogued at 10 m. The strongest flow was in a narrow jetlike current (30 cm/s) along the northern flank of the Bank. The flow of shelf water on the southern flank was westward (10 cm/s) toward the Middle Atlantic Bight; some of this water flowed northward through the eastern side of Great South Channel and recirculated around Georges Bank. The satellite-tracked drifters and the moored observations indicate that the circulation around the Bank was not completely closed and considerable variability occurs in the trajectory of an individual water particle.

Nearly continuous current measurements at 45 and 75 m were made from May

1975 to March 1979 at 40°51'N, 67°24'W on the southern flank of Georges Bank in water 85 m deep. Hydrographic observations suggest that all of the mean shear and all of the seasonal variation between 45 and 75 m can be attributed to the seasonal change in the cross-bank density field. The current observations on the southern flank and additional measurements made at other locations around the perimeter of the Bank suggest that although a subsurface clockwise circulation around the Bank exists throughout the year, the flow was strongest in late summer and early fall and that recirculation around Georges Bank may be most likely in late summer. The flow was weakest and most variable in winter.

Strong correlations were observed among subtidal longshelf currents from the Middle Atlantic Bight (MAB) to the Georges Bank region, a distance spanning 615 km. The longshelf current consisted predominantly of wind-forced motions and free waves, which together accounted for 75-90 percent of the longshelf current energy. Much stronger longshelf currents were observed in the MAB than on Georges Bank. The MAB/Georges Bank energy ratio for wind-forced currents on the 60-m isobath was 20. Surface and bottom stresses, the longshelf pressure gradient, and Coriolis force on the cross-shelf flow were important terms in the longshelf momentum balance. An analytic model of wind-forced current, which incorporated the significant force balances, accounted for the longshelf variation in wind-forced currents.

Observations of the semidiurnal (M_2) tidal current, bottom pressure, and coastal sea level from Nova Scotia to Cape May, New Jersey show that: 1) the surface pressure at the edge of the Continental Shelf in the study area has a relatively uniform amplitude (40 cm) and phase (12 hr Greenwich); 2) in the Mid-Atlantic Bight, the semidiurnal M_2 tide is co-oscillating, and the onshore M_2 tidal current reaches a maximum approximately 90° or 3.1 hr before high water; 3) in the Georges Bank region of the shelf, the M_2 tide is more progressive than it is in the Mid-Atlantic Bight, and the onshore M_2 tidal current in the Georges Bank region of the shelf reaches a maximum about 7° or 14 min before high water; 4) the strongest M_2 tidal currents observed in the study area are near the crest of Georges Bank (typical amplitudes are 74 cm/s near the surface); 5) the M_2 tidal currents are weaker in the Mid-Atlantic Bight (typical amplitudes are 16 cm/s near the surface) than on Georges Bank; and 6) the tidal currents are weakest near the bottom south of Cape Cod in a region of transition between progressive and co-oscillating tides.

The highest concentrations of suspended matter in bottom waters on the Continental Shelf occur between Georges Bank and the Middle Atlantic states over the area of fine-grained sediments south of Martha's Vineyard known as the Mud Patch. Active resuspension of bottom sediments appears to take place under the influence of tidal currents, perhaps aided by the activity of bottom fauna. The distribution of turbidity maxima with depth remained generally constant over the 24-hour sampling period. A significant effect of rapidly recycled particulates in the water column is the enhanced opportunity for absorption of dissolved pollutants. During winter, this process may be important over much of the shelf and throughout the water column due to the lack of water-column stability and because of extensive vertical mixing of resuspended sediments.

An area of fine-grained sediment approximately 170 km x 74 km in size, located in water depths between 60 m and 150 m south of Martha's Vineyard, Massachusetts, is a site of modern sediment deposition. The high accumulation rates, ^{210}Pb inventories, and trace-metal profiles imply that this area is a modern sink for fine-grained sediments and for pollutants associated with particulate matter in the water column. This is the only site of present-day natural deposition on the Continental Shelf off the eastern United States, exclusive of the Gulf of Maine. Because the net currents on the outer half of this Continental Shelf flow from northeast to southwest, this fine-grained deposit may receive its sediments and possible contaminants from the Nantucket Shoals and Georges Bank regions.

Four bed-form provinces have been identified on Georges Bank using sidescan-sonar and echo-sounding techniques: large sand waves superimposed on sand ridges, small sand waves, megaripples, and featureless sea floor. The large sand waves and sand ripples are found on the Bank crest where the surface tidal currents are strongest. Areas of small sand waves and megaripples, formed where tidal currents are moderate in strength, border the area of large sand waves to the north and south. Featureless sea floor is found farthest from the Bank crest where surface tidal currents are weakest.

Seismic-refection profiles show that the fine-grained deposit, which is as much as 13 m thick, has accumulated during the last transgression because it rests on a reflector that is geomorphically similar to and continuous with the Holocene transgressive sand sheet still exposed on the shelf to the west. The ridge and swale topography comprising the sand sheet on the shelf off New Jersey and Long Island are relict in origin as these same features are found buried under the fine sediment deposit. Southwestward migrating megaripples observed on the sonagraphs in the eastern part of the deposit are evidence that sediment is still actively accumulating in this area. In the western part of the deposit, where surface sediment is composed of silt plus clay, evidence of present sediment mobility consists of changes in the near-bottom suspended-matter concentrations primarily associated with storms. Nantucket Shoals and Georges Bank are thought to be the sources for the fine-textured sediment.

The surficial sediments on the Continental Slope off Georges Bank tend to be highly plastic, inorganic silts and clays. Measurements of shear strength and index properties, and inferences concerning consolidation state suggest that the sites of two cores were once buried under a considerable amount of overburden. They may be mass-movement scars. Slope stability analyses and indirect assessments of consolidation states suggest that the surficial sediments cored are stable with respect to mass movement.

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Continental Shelf and Slope off the New England States. *In* Geotechnology in Massachusetts, ed. by O.C. Farquhar. Graduate School, University of Massachusetts, Amherst, MA.

Aaron, J.M., B. Butman, M.H. Bothner, and R.E. Sylwester. 1980. Environmental conditions relating to potential geologic hazards, U.S. northeastern Atlantic continental margin. U.S. Geological Survey Miscellaneous Field Studies Map MF-1193.

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Bothner, M.H., E.C. Spiker, P.P. Johnson, R.R. Rendigs, and P.J. Aruscavage. 1981. Geochemical evidence for modern sediment accumulation on the Continental Shelf off southern New England. Journal of Sedimentary Petrology 51:281-292.

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Butman, B., and M.A. Noble. 1978. *In situ* observations of bottom sediment movement on the U.S. Atlantic Continental Shelf (abs.). Transactions, American Geophysical Union 59:295.

Butman, B., J. Vermersch, R.C. Beardsley, and M. Noble. 1978. Longterm current observations on Georges Bank. Transactions, American Geophysical Union Transactions 59:302.

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Miller, R.E., D.M. Schultz, H.E. Lerch, D.T. Ligon, and D.K. Owings. 1981. Summary report of the residual light hydrocarbon analyses of interstitial gases in piston core samples from the North and Mid-Atlantic Continental Shelf environments. U.S. Geological Survey

Open-File Report 81-775.

Miller, R.E., D.M. Schultz, H.E. Lerch, J. Zalibor, and D.K. Owings. 198x. Studies of interstitial gas of piston core samples from the North and Mid-Atlantic Outer Continental Slope. U.S. Geological Survey Open-File Report (in press).

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O'Leary, D.W., 1985. The Munson-Nygren slide, a major lower-slope slide off Georges Bank. (Director's Approval, 5/85).

O'Leary, D.W. 1985. Style and origin of mass movement along the New England Continental Slope. (Director's Approval, 5/85).

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Parmenter, C.M., M.H. Bothner, and B. Butman. 1981. Characteristics of resuspended sediment from Georges Bank collected with a sediment trap (abs.). Proceedings, Third informal workshop on the oceanography of the Gulf of Maine and adjacent seas, University of New Hampshire, Durham, NH, p. 103.

Rendigs, R.R., M.H. Bothner, and L.J. Poppe. 1981. Sediment parameters for a fine-grained sediment deposit on the southeastern New England Continental Shelf. U.S. Geological Survey Open-File Report 81-1334, 41 p.

Schlee, J.S., compiler. 1981. Summary report of the sediments, structural framework, petroleum potential and environmental condition of the United States middle and northern continental margin in the area of the proposed Oil and Gas Lease Sale No. 82. U.S. Geological Survey

Open-File Report 81-1353.

Schlee, J.S., J.M. Aaron, M.M. Ball, K.D. Klitgord, J.A. Grow, B. Butman, and M.H. Bothner. 1979. Summary report of the sediments, structural framework, petroleum potential, and environmental conditions of the United States northeastern Atlantic continental margin. U.S. Geological Survey Open-File Report 79-674, 52 pp., 12 figs.

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Twichell, D.C. and C.E. McClennen. 1979. Anomalous fine sediments on the southern New England Continental Shelf (abs.). Geological Society of America, Abstracts with Programs v. 11, no. 1, p. 56.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM

MU0-16/29175
MU0-18/29175
IA1-15/29183
IA1-17/29184
IA2-26/29196
CT5-42 & MU5-33
CT6-62 & MU7-31
MU6-29
MU6-56
MU8-13
MU8-21
MU9-04
MU9-08/29166

NORTH ATLANTIC

Physical Oceanography

BLM CONTRACT NO. AA550-CT6-50

TITLE: EG&G New England Physical Oceanography, Year 1

DATE: 9 September 1976 - 31 August 1979

COST: $1,416,804

PRIME CONTRACTOR:

EG&G International, Inc. (EGG)
Environmental Consultants Division
300 Bear Hill Road
Waltham, Massachusetts 02154

SUBCONTRACTORS/COOPERATING INSTITUTIONS:

Raytheon
University of Delaware (UD)
University of Rhode Island (URI)
John A. Vermersch

CHARTERED RESEARCH VESSELS:

R/V *Atlantic Twin*
Whitefoot Tug
R/V *Sub Sig* II

PROGRAM MANAGER:

Richard Scarlet

PRINCIPAL PARTICIPANTS:

David O. Cook
C. Flagg
Daniel E. Frye
Bruce Magnell
Christopher N. K. Mooers (UD)

CONTRACTING OFFICER:

Anthony F. Guida
Jeffrey P. Petrino

COR: Kenneth J. Berger

FINAL REPORT:

The data from this contract have been interpreted and synthesized in the final report of Contract No. AA851-CT1-39.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-39/29188 (fig. 5)
CT6-53
CT8-46
CT8-47

BLM CONTRACT NO. AA851-CT6-53/29159

TITLE: Raytheon New England Physical Oceanography, Year 1

DATE: 21 September 1976 - Incomplete

COST: $3,812,767

PRIME CONTRACTOR:

Raytheon Company
P.O. BOX 360
Portsmouth, Rhode Island 02871

FINAL REPORT:

The data from this study have been interpreted and synthesized in the final report of Contract No. AA851-CT1-39.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-39/29188 (fig. 5)
CT6-50
CT8-46
CT8-47

BLM CONTRACT NO. AA551-CT8-46

TITLE: EG&G New England Physical Oceanography Study, Year 2

DATE: September 1978 - June 1980

COST: $2,122,850

PRIME CONTRACTOR:

EG&G International, Inc. (EGG)
Environmental Consultants Division
300 Bear Hill Road
Waltham, Massachusetts 02154

FINAL REPORT:

The data from this contract have been interpreted and synthesized in the final report of Contract No. AA851-CT1-39.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-39/29188
CT6-50
CT6-53
CT8-47

BLM CONTRACT NO. AA551-CT8-47/29162

TITLE: Raytheon New England Physical Oceanography, Year 2

DATE: 28 September 1978 - Incomplete

COST: $696,990

PRIME CONTRACTOR:

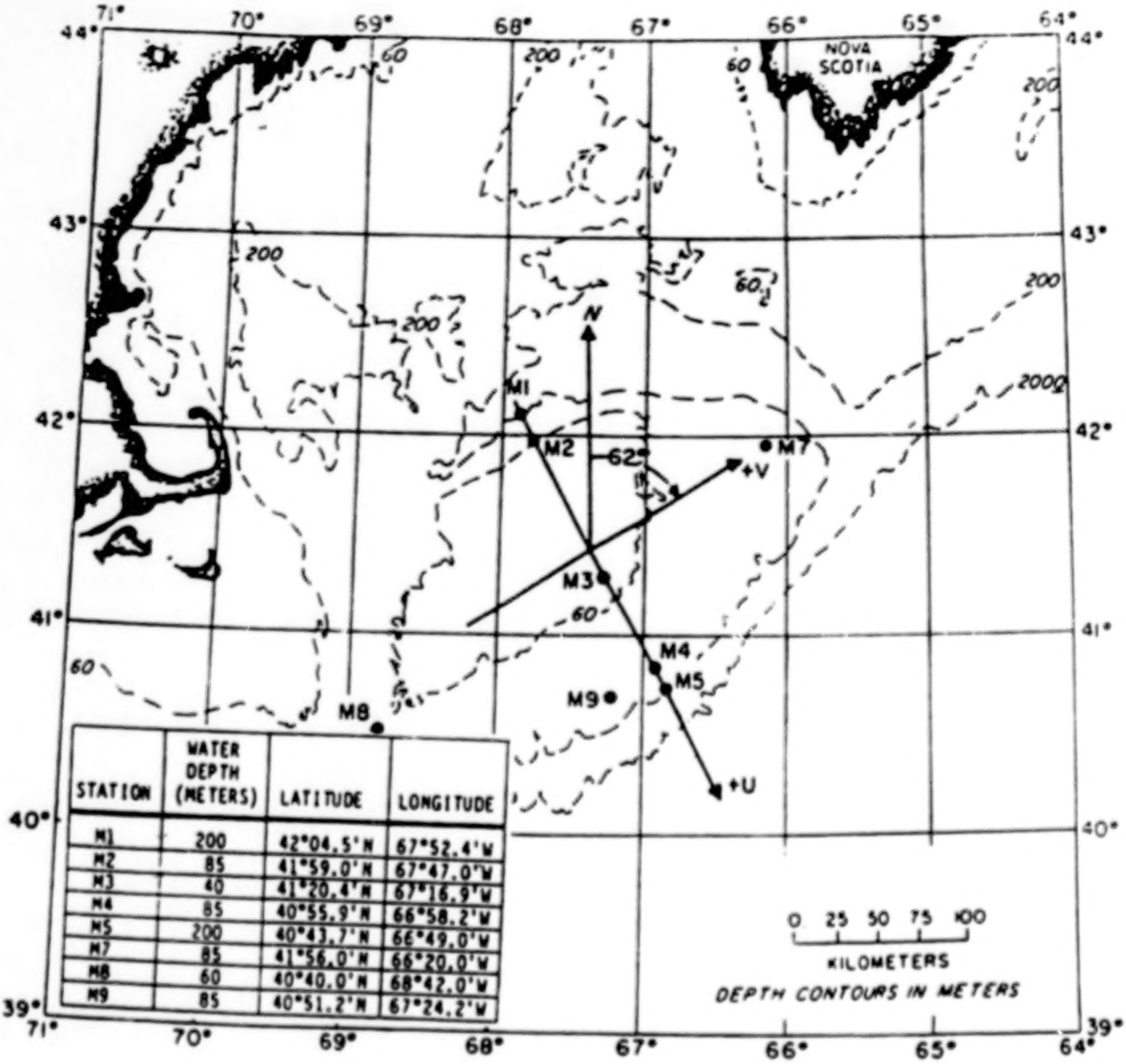
Raytheon Company
P.O. BOX 360
Portsmouth, Rhode Island 02871

FINAL REPORT:

The data from this study have been interpreted and synthesized in the final report of Contract No. AA851-CT1-39.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-39/29188
CT6-50
CT6-53
CT8-46/29163



STATION	WATER DEPTH (METERS)	LATITUDE	LONGITUDE
M1	200	42°04.5'N	67°52.4'W
M2	85	41°59.0'N	67°47.0'W
M3	40	41°20.4'N	67°16.9'W
M4	85	40°55.9'N	66°58.2'W
M5	200	40°43.7'N	66°49.0'W
M7	85	41°56.0'N	66°20.0'W
M8	60	40°40.0'N	68°42.0'W
M9	85	40°51.2'N	67°24.2'W

Figure 5. Location of moored instrument stations for the New England Physical Oceanography Program. Data were synthesized under Contract No.AA851-CT1-39.

BLM CONTRACT NO. AA851-CT1-39/MMS CONTRACT NO. 14-12-0001-29188

TITLE: Interpretation of Physical Oceanographic Conditions and their Applications to Pollutant Transfer in the North Atlantic U.S. Outer Continental Shelf

DATE: 27 April 1981 - 13 August 1982

COST: $824,414

PRIME CONTRACTOR:

EG&G International, Inc. (EGG)
Environmental Consultants Division
300 Bear Hill Road
Waltham, Massachusetts 02154

SUBCONTRACTORS/COOPERATING INSTITUTIONS:

Applied Sciences Associates (ASA)
Associated Scientists of Woods Hole (ASWH)
University of Delaware (UD)
University of New Hampshire (UNH)

PROGRAM MANAGER:

Richard I. Scarlet

PRINCIPAL PARTICIPANTS:

Wendell S. Brown (UNH)
Jerome J. Cura, Jr.
Charles N. Flagg
Daniel E. Frye
Richard Garvine (UD)
George R. Halliwell, Jr. (UD)
James D. Irish (UNH)
Tatsusaburo Isaji (ASA)
Bruce A. Magnell
George M. Mariani
Charles A. Menzie
Charles N. M. Mooers (UD)
Neal Pettigrew (UNH)
Malcolm L. Spaulding (ASA)
Craig Swanson (ASA)
W. Redwood Wright (ASWH)

CONTRACTING OFFICER:

Jeffrey P. Petrino

COR: William H. Lang

OBJECTIVES:

The sole purpose of this study was to synthesize and interpret physical oceanographic data collected for the BLM (now MMS) by Raytheon (CT6-53, CT8-47), EG&G (CT6-50, CT8-46), and when appropriate, USGS (MU6-29, MU8-24, MU9-4, and MU0-18). The above data will be interpreted in light of the following objectives to:

1. Develop and refine concepts of the transport, dilution, and dispersion processes acting on the New England Outer Continental Shelf (OCS) (fig. 6).

2. Qualify and quantify the various transport processes such that the fate of OCS oil and gas related discharges released on Georges Bank can be described.

3. Develop a conceptual model of the mean circulation on Georges Bank with a quantitive description of the variability of the circulation and the exchange rates which dominate the movement of pollutants and nutrients.

4. Identify source regions for nutrients, geographic areas of high productivity, and to establish residence times on Georges Bank.

FINAL REPORT:

Interpretations of the Physical Oceanography of Georges Bank (C. N. Flagg, B. A. Magnell, R. Frye, J. J. Cura, S.E. McDowell, R.I. Scarlet; 1982)

AVAILABILITY:

Available from NTIS:
Final Report (Vol. I) - PB83149054
Appendices (Vol. II) - PB83149062

SUMMARY:

This analysis includes hydrographic fields (temperatures, salinities, densities, and nutrients), currents measured by moored current meters and drogues, productivity and plankton assemblages, and meteorological forcing fields. The report presents and describes the determination of average values and seasonal cycles of these properties. Interpretations of mixing and exchange rates, residence times, nutrient sources, and water mass formation are presented. Dynamics of the currents, and their relation to winds, storms, tides, and density fields are analyzed, and numerical model simulations of wind-driven currents are compared with observations. Features studied in particular detail include the Georges Bank gyre circulation, the cold band, the influence of Gulf Stream eddies on the shelf/slope front, and factors associated with enhanced biological productivity.

The physical oceanography of Georges Bank is characterized by the presence of a gyre whose currents move in a clockwise direction. Seasonal differences in the current speed and gyre were noted. Detailed seasonal and annual average maps of current structure and hydrography in and around Georges Bank were presented. Residence time for water on Georges Bank, based on drogue and current meter measurements, was consistent with the box model flow for the New England OCS, and ranged from 40 to 80 days. Drogue residence time in summer was 66 days vs. 45 days in winter. The difference was attributed to increased closure of the gyre circulation in summer.

The Georges Bank gyre consists of clockwise currents flowing around the Bank. The gyre is more intense and closed in summer than in winter. A closed gyre suggests that contaminants in the water column could be trapped around the bank.

In winter, a narrow current (about 20 km wide), called a jet, flows eastward along the north margin of the bank at approximately the 80-m isobath. The jet originates in an area north and east of Great South Channel and derives its initial water from the Wilkinson Basin. Currents in this jet average 18 cm s^{-1} near the surface and 7 cm s^{-1} at 80-m depth. Along the bank's south side, this current averages 12 cm s^{-1} on the surface and 3 cm s^{-1} in 85 m of water. Only 25% of the flow recirculates into the Great South Channel and rejoins the northern jet.

In summer, currents in the gyre increase in speed starting on the north side (42 cm s^{-1} at surface; 21 cm s^{-1} at 80 m). The proportion of westward-flowing water along the south of the bank that turns north through the channel increases, reaching a maximum of 65% during late July. The Gulf of Maine and the waters of Georges Bank are thermally stratified due to summer heating and the surface water has become distinct from the intermediate depth water.

For construction of the box model, transports were calculated through vertical sections around Georges Bank, past Cape Sable-Browns Bank, through the Nantucket Flux array, and through the Northeast Channel. Results indicated a shelf water system driven by two major inputs: (1) water from the Scotian Shelf (52%) and (2) water from the Northeast Channel (43%). Outflow was primarily along the shelf south of Cape Cod (48%) and water displacement offshore by the shelf/slope front eddies (37%). The annual mass flux rate was 748 x 10^3 m^3 s^{-1}, representing a flushing time of 280 days for the whole region. In winter, the flushing rate dropped to 256 days, while in summer it rose to 305 days.

Major nutrient sources on Georges Bank are considered to be Gulf of Maine surface water and intermediate water. This study showed a close spatial correlation between measures of mixing history and planktonic species assemblages.

Data from New England Outer Continental Shelf Physical Oceanography (NEOCSPO) cruises showed that the "cold band" off Georges Bank is totally replenished every 30 to 60 days. Detailed examination of NEOCSPO data showed four sources for the water in the cold band: (1) the central region of Georges Bank; (2) near surface in the Gulf of Maine; (3) mid-depth along the bank's north flank; and (4) from 100 to 150 m deep in the Northeast Channel. These waters become mixed at the Northeast Peak to form the cold bank. The migration of the deep Northeast Channel water is important because it provides a pathway for nutrient-rich cold deepwater to reach the biological communities of the bank.

OTHER REPORTS/PUBLICATIONS:

Brown, W. S., 1984. A comparison of Georges Bank, Gulf of Maine and New England Shelf tidal dynamics. J. Phys. Oceanogr. 14:145-167.

Cura, J. J., and J. H. Ryther. Relationships between phytoplankton distribution and production and the physical oceanography in the Georges Bank region (90 p. manuscript).

Halliwell, G. R., and C. N. K. Mooers. Meanders of the Gulf Stream downstream from Cape Hatteras, through 1978 (50 p. manuscript).

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT6-50
CT6-53
CT8-46
CT8-47

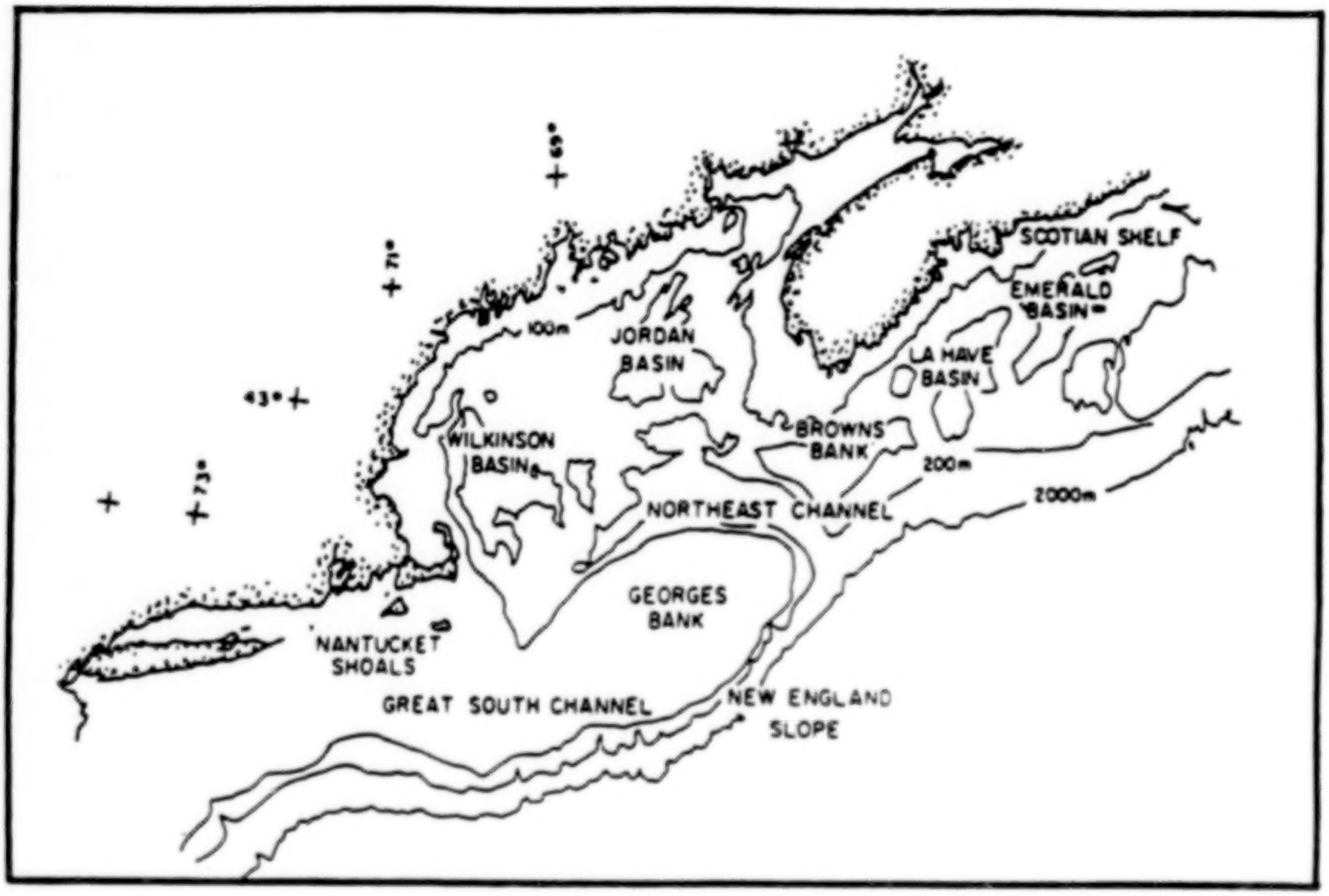


Figure 6. Study area for "Interpretation of Physical Oceanographic Conditions and their applications to Pollutant Transfer in the North Atlantic U.S. Outer Continental Shelf", BLM Contract No. AA851-CT1-39.

BLM CONTRACT NO. AA551-IA8-14

TITLE: Georges Bank Climatological and Oceanographic Analysis

DATE: March 1978 - September 1979

COST: $394,847

PRIME CONTRACTOR:

National Oceanic and Atmospheric Administration (NOAA)
Marine Environmental Assessment Division
Center for Environmental Assessment Services
Washington, D.C. 20036

PROGRAM MANAGER:

Fredric A. Godshall

PRINCIPAL PARTICIPANTS:

Joseph M. Bishop
Fred Everdale
Steven W. Fehler
Robert G. Williams

OBJECTIVES:

1. Use environmental data from the national archives (The National Oceanographic Data Center and National Climatic Center) to produce an oceanographic analysis of the Georges Bank region.

2. Produce climatology and wave analyses to provide information related to ship operations and the surface movement of pollutants.

3. Produce summaries of archived data for the study region.

FINAL REPORT:

A Climatologic and Oceanographic Analysis of the Georges Bank Region of the Outer Continental Shelf (F.A. Godshall, et.al; 1980)

AVAILABILITY:

Final Report is available from Minerals Management Service, Vienna, Virginia 22180

SUMMARY:

The surface wind field in the study area (fig. 7) varies from a northwesterly wind regime in winter to a southwesterly wind regime in summer. The summer wind direction in the southeastern portion of the study region is veered relative to wind in the northwestern part of the region, reflecting the dominance of the Atlantic subtropical anticyclone. In winter intraregional wind direction differences seemed to be associated with sea-air temperature differences. Apparently, the effectiveness of wind-forced surface circulation was about equal to the combined effect of tide and residual (regional scale) circulation. Advection fog was the most frequently occurring restriction to visibility in the study region. Visibility less than 10 nautical miles (nmi) occurred about 70 percent of the time in the Georges Bank area in spring. North of 42°N (northern half of the study region) at least light ship icing may be expected on the order of 1 percent of the time over 5 months of the year.

Shelf and slope water masses were found within the study region. Because of deep basins and channels in the shelf, highly saline slope waters intruded into the bottom layers of central geographic areas of the study region. With relatively low saline water (from outflow of the Gulf of St. Lawrence and from local rivers) on the surface, high static stability of the water column is common to most of the study region. A cold intermediate-depth layer (with temperature of about 2° to 8°C), found at depths greater than about 75 m, is produced by winter-cooled water overturned and maintained through summer by the general absence of strong vertical mixing. Except in the relatively shallow areas (depths less than 75 m) where well-mixed water usually prevails, vertical mixing and modification of water column structure occurs intermittently. Surface temperatures on Georges Bank and other shallow areas of the region (without consideration of nearshore area) tended to be relatively warm in winter and cool in summer because of vertical mixing. An area of relatively high surface salinity (maximum concentration in November) occurred over the basins in the Gulf of Maine, produced by vertical mixing of relatively saline bottom and mid-depth waters.

By the use of hydrographic summaries and assumption of geostrophy, diagnostic modeling efforts produced seasonal circulation pattern estimates for the study region. These patterns were in agreement with the classical descriptions of general circulation of the region, i.e., a cyclonic gyre in the Gulf of Maine and an anticyclonic gyre over Georges Bank are established in spring. In winter the mid-Gulf of Maine gyre (maintained in subsurface layers) appeared poorly organized at the surface; flow over Georges Bank was from the Gulf of Maine. A net annual cyclonic circulation gyre extends over the Scotian Shelf.

Better understanding of intraregional variations of hydrographic and nutrient variables can be obtained by defining water mass properties and evaluating mixing. In general, mixing is produced by turbulence and small scale circulation features. It was recommended that information about smaller scale circulation features be organized in context of the known characteristics of the broader, regional scale of circulation in order to faciliate the interpretation of the results of the measurement programs for applications at other times and locations.

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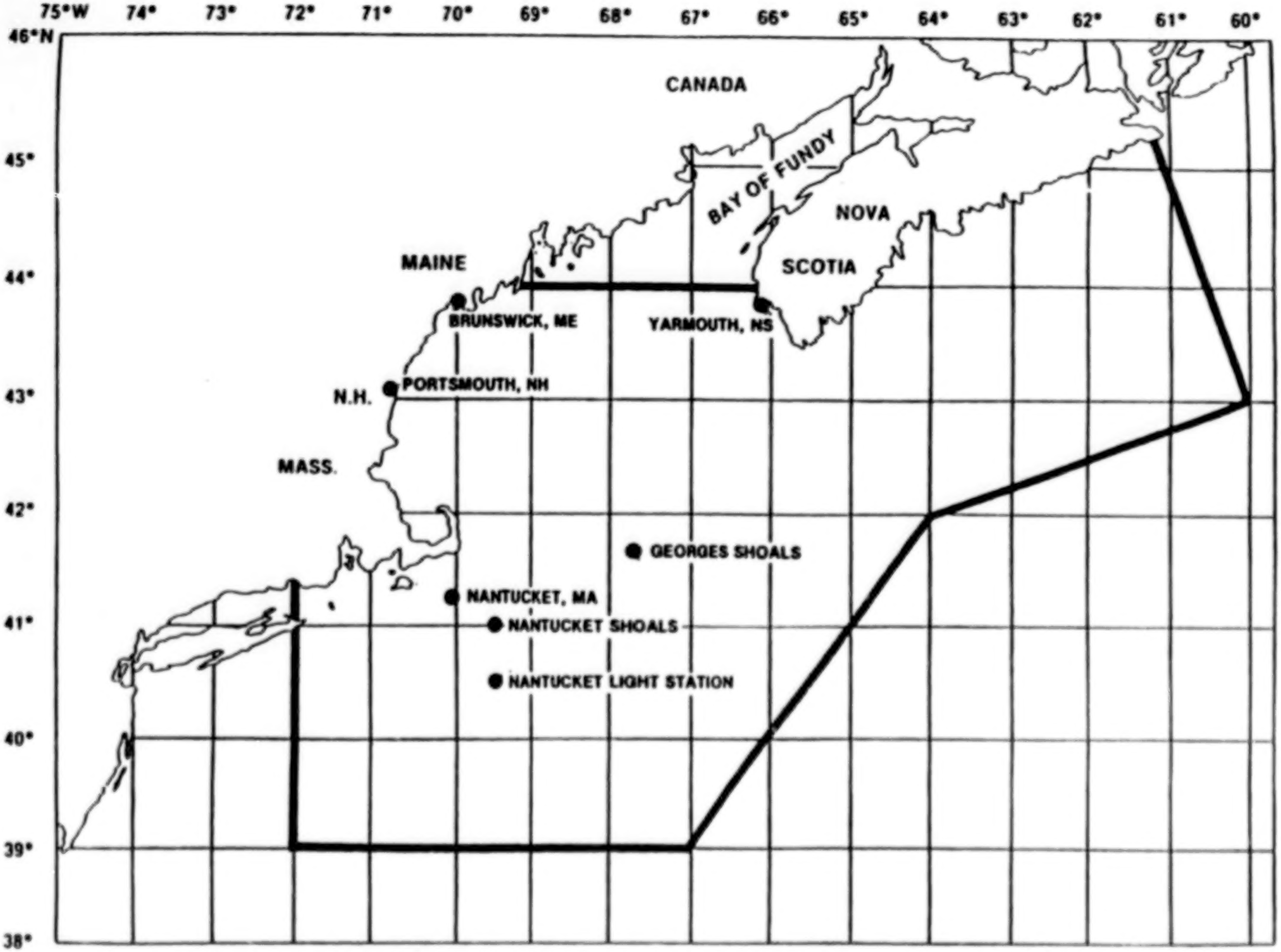

Figure 7. Study area for the Georges Bank Climatological and Oceanographic Analysis Program, BLM Contract No. AA551-IA8-14.

MMS INTERAGENCY AGREEMENT NO. 14-12-0001-30180

TITLE: North Atlantic Slope and Canyon Study (NASACS)

DATE: March 1984 - July 1986

COST: $842,061 (estimated)

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTOR/COOPERATING INSTITUTIONS:
Woods Hole Oceanographic Institution (WHOI)
Eliason Data Services (EDS)

CHARTERED RESEARCH VESSELS:
R/V Oceanus

PROGRAM MANAGER:
Brad Butman

PRINCIPAL PARTICIPANTS:
Mike Bothner
John Moody
Skip Little (WHOI)

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: James Lane

OBJECTIVES:

This study will continue field measurements made by USGS on shelf, slope, and canyon currents in the North Atlantic region. General objectives of the study are to:

1. Complete field measurements at established slope stations in the North Atlantic region and analyze the time-series data with special emphasis on long-term processes and low frequency fluctuations critical to understanding sediment (and pollutant) pathways.

2. Complete interpretation of data from the Canyon Dynamics Experiments and verify (or modify) preliminary results reported in the FY '80-'82 Report (IA No. 29196).

3. Provide a written summary of field results, interpreted in conjunction with complimentary field programs of the Department of Energy, WHOI, and the MMS Mid-Atlantic Slope and Rise Study (MASARS),

and provide a concise account of study conclusions, highlighting significance to proposed oil and gas activities in the North Atlantic slope and rise area.

FINAL REPORT:

Butman, B., 1984. First Annual Progress Report North Atlantic Slope and Canyon Study October, 1984. Submitted to Minerals Management Service.

OTHER PUBLICATIONS/REPORTS:

Butman, B. and J.A. Moody. 1984. A bathymetric map of Lydonia Canyon, U.S. Atlantic Outer Continental Shelf. U.S. Geological Survey Miscellaneous Field Studies Map MF-1710.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

IA1-17/29184
IA2-26/29196
30066

NORTH ATLANTIC

Drill Site Monitoring

BLM CONTRACT NO. AA851-CT1-69/MMS CONTRACT NO. 14-12-0001-29190

TITLE: Analysis of Historical Benthic Infaunal Samples from Georges Bank

DATE: 30 September 1981 - 18 March 1983

COST: $100,706

PRIME CONTRACTOR:
Taxon, Inc.
50 Grove Street
Salem, Massachusetts 01970

PROGRAM MANAGER:
Allan Michael

PRINCIPAL PARTICIPANTS:
Charlene Long
Richard McGrath

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Jeffrey L. Hyland

OBJECTIVES:
This study is part of the Georges Bank monitoring program which is designed to address the following specific questions:

1. What are the quantities, the physical characteristics, and the chemical composition of materials discharged during outer continental shelf (OCS) drilling operations?

2. Where do discharged materials accumulate (e.g., heads of submarine canyons, the "mud patch", around rigs) and in what concentrations?

3. What are the existing background levels of contaminants in the sediments and biota and what levels above background can be detected with state-of-the-art technology?

4. Do benthic populations change at selected regions on Georges Bank during various stages of OCS oil and gas activity compared with control sites; can these changes be related to observed changes in pollutant levels associated with discharges; and what are the concentrations of pollutants associated with these changes?

FINAL REPORT:

Georges Bank Benthic Infauna Historical Study (A. D. Michael, C.D. Long, D. Maurer, R. A. McGrath; 1983)

AVAILABILITY:

Available from NTIS: Final Report - PB83252114

SUMMARY:

Benthic infaunal samples were collected with a 0.1-m^2 Van Veen grab at a number of stations on Georges Bank and adjacent areas in 1977. Replicate samples were collected quarterly and sieved to 0.5 mm. Samples were analyzed from 11 of these stations that coincided with stations that were sampled during the more recent Georges Bank Monitoring Program. Approximately 700 taxonomic categories were identified from these 11 stations. Polychaetes were numerically dominant in most samples and represented the greater proportion of species. The next most abundant and diverse group was the amphipods followed by the molluscs and echinoderms. Sediments were primarily medium to fine sands with low silt/clay content. Stations in the Gulf of Maine, Lydonia Canyon, and mud patch had higher silt/clay content. Faunal densities and species richness increased with depth across the bank and from east to west. Most stations had faunal densities in the range of 4,000-14,000 individuals per m^2. Numbers of species per 0.1-m^2 replicate typically ranged from 50-60. Shallow stations were dominated by haustoriid amphipods. All other stations were dominated by polychaetes, although the amphipod, Ampelisca agassizi was the most abundant species at several stations. With increasing depth and decreasing particle size, the amphipod component of the fauna diminished and the polychaete and molluscan components increased. Faunal composition was stable throughout the year. Inter-replicate variation was extremely low in most cases.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT2-07/29192
CT2-33/29198
IA2-18/29194
30001
30025
30153

BLM CONTRACT NO. AA851-CT2-07/MMS CONTRACT NO. 14-12-0001-29192

TITLE: Georges Bank Benthic Infauna Monitoring, Year 1-3

DATE: 21 January 1982 - March 1985

COST: $3,998,016

PRIME CONTRACTOR:
Battelle New England Marine Research
Laboratories (BNEMRL)
397 Washington Street
Duxbury, Massachusetts 02332

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Woods Hole Oceanographic Institution (WHOI)

CHARTERED RESEARCH VESSELS:
R/V Endeavor
R/V Gyre
R/V Oceanus
R/V Cape Henlopen

PROGRAM MANAGER:
Jerry M. Neff

PRINCIPAL PARTICIPANTS:
Nancy Maciolek-Blake
J. Frederick Grassle (WHOI)
George Hampson (WHOI)
Howard L. Sanders (WHOI)

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Jeffrey L. Hyland
Rosalind E. Cohen
Alyce T. Fritz

OBJECTIVES:
This study is part of the Georges Bank Monitoring Program which is designed to address the following specific questions:

1. To determine pre-drilling characteristics of benthic communities in the Georges Bank Lease Sale 42 area.

2. To monitor potential changes in these pre-drilling characteristics with time, and determine whether the changes are caused by drilling-related activities or whether they are the result of other phenomena including natural temporal or spatial variation.

FINAL REPORTS:

The Georges Bank Benthic Infauna Monitoring Program (J.A. Blake, J.F. Grassle, N. M. Blake, J. M. Neff, H. L. Sanders; 1983).

Georges Bank Benthic Infauna Montoring Program: Final Report for the Second Year of Sampling (N. M. Blake, J. F. Grassle, J. A. Blake, J. M. Neff; 1984).

Georges Bank Benthic Infauna Monitoring Program: Final Report for the Third Year of Sampling (N.M. Blake, J.F. Grassle, J.M. Neff, 1985).

AVAILABILITY:

Available from NTIS:
Final Report, Year 1 - PB83204529
Executive Summary, Year 1 - PB83204511
Final Report, Year 2 - PB84169457
A review copy of the Third Year report is available at the Minerals Management Service, Vienna, Virginia.

SUMMARY:

First and Second Years: Concerns about the potential effects of oil and gas exploration activities on the highly productive Georges Bank off the coast of Massachusetts led to the initiation of a monitoring program in July 1981. The program included intensive sampling of the benthic communities, collected near, upcurrent, and downcurrent of the drilling rigs; analysis of bottom photographs for epifauna and microtopography; dredge and trawl collections of bottom fauna; and CHN and sediment grain size analysis. Collections of six replicate infaunal samples at each of 46 stations were made on a seasonal basis. Samples were collected with a 0.04-m^2 modified Van Veen grab sampler and were double live-sieved through 500-um and 300-um screens. Twenty-nine stations were positioned in a tight radial array around one rig at 80 m. A second group of three stations were near a rig site at 145 m. The remaining stations covered a broad expanse of the Bank and nearby areas of potential deposition of drilling materials. Use of the 300-um screen resulted in the retention of newly settled and juvenile forms, as well as small-bodied species which are normally poorly sampled by larger screens. The ability to identify the earliest juvenile stages of several species enabled accurate counts of each species and prediction of times of settlement. Results from the first four biological collections indicated little heterogeneity within stations, with good replication between samples. A strong relationship between faunal composition and both sediment type and depth was indicated by cluster analysis. No biological impacts attributable to drilling activities have been detected to date at any station, including the site-specific array in Block 312, the three stations near the drill rig in Block 410, or any regional station monitored in this program.

Third Year: No significant changes in benthic infaunal community structure which can be attributed to the drilling of eight dry wells on Georges Bank were detected during and for at least two years after drilling by the methods of analysis used. Biological patterns in benthic infauna were similar throughout the three years of the Monitoring Program. Abundance of individual species and overall benthic community structure changed very little with season at any station. At stations at or deeper than 100 m (e.g., Stations 3, 6, 8, 9, and Block 410), the samples were very homogeneous within years and it was possible to resolve subtle differences between years. During the three years of the Monitoring Program, the replicate infaunal samples from each regional station showed an exceptionally high degree of homogeneity. Cluster analysis demonstrated that all of the replicates of any one regional station were more similar to each other than to replicates from any other station. The benthic community of any particular station was always distinct from the community at any other station. When replicates from each sampling date were summed, the samples from each of the 12 sampling periods clustered together before joining with samples from any other station. Biomass varied over time and among stations. At some stations there were significant increases in biomass between the first and second years. Clams (Artica islandica) and sand dollars (Echinarachnius parma) dominated the biomass when they were present. When A. islandica and E. parma were absent, polychaetes and arthropods dominated the biomass. Levels of wet-weight biomass found in this study were similar to estimates from other studies. Bottom photographs taken during the Monitoring Program revealed depth-related patterns of microtopography. On the 60-m contour, well-defined ripples were present most of the year. Seasonal differences in ripple patterns were seen at stations along the 70-80-m contour, including the site-specific array in Block 312. Such differences were not seen at stations along the 100-m contour, where little rippling of sediments was noted. Seasonal differences in sediment microtopography were seen at the Block 410 stations at 145 m. Results of the faunal analysis of the photographs corroborated the results of the grab sample analysis. For example, the patchy distribution of the sand dollar Echinarachnius parma at the 60-m stations was obvious in both analyses.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-69/29190	30001
CT2-33/29198	30025
IA2-18/29194	30153

BLM CONTRACT NO. AA851-CT2-33/MMS CONTRACT NO. 14-12-0001-29198

TITLE: Georges Bank Monitoring Program: Analysis of Hydrocarbons in Bottom Sediments and Analysis of Hydrocarbons and Trace Metals in Benthic Fauna, Year 1

DATE: 7 May 1982 - 28 May 1983

COST: $103,941

PRIME CONTRACTOR:
Science Applications, Inc. (SAI)
Division of Environmental Chemistry and Geochemistry
476 Prospect Street
LaJolla, California 92308

CHARTERED RESEARCH VESSELS:
(see Contract No. 29192)

PROGRAM MANAGER:
James R. Payne

PRINCIPAL PARTICIPANTS:
James R. Payne

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Jeffrey L. Hyland

OBJECTIVES:
This study is part of the Georges Bank Monitoring Program which is designed to address the following specific questions:

1. What are the quantities, the physical characteristics, and the chemical composition of materials discharged during outer continental shelf (OCS) drilling operations?

2. Where do discharged materials accumulate (e.g., heads of submarine canyons, the "mud patch", around rigs) and in what concentrations?

3. What are the existing background levels of contaminants in the sediments and biota and what levels above background can be detected with state-of-the-art technology?

4. Do benthic populations change at selected regions on Georges Bank during various stages of OCS oil and gas activity compared with control sites; can these changes be related to observed changes in pollutant levels associated with discharges; and what are the concentrations of pollutants associated with these changes?

FINAL REPORT:

Georges Bank Monitoring Program: Analysis of Hydrocarbons in Bottom Sediments and Analysis of Hydrocarbons and Trace Metals in Benthic Fauna (SAI, 1982)

AVAILABILITY:

Available from NTIS:
Final Report - PB83180778
Appendices - PB83180786

SUMMARY:

This program was conducted to document background hydrocarbon and trace metal levels in selected sediments and benthic fauna, and to monitor potential short- and long-term changes which may result from exploratory drilling activities in the Georges Bank Lease Sale 42 region. Aromatic hydrocarbon component levels in the sediments immediately around the Mobil Oil drill rig, *Rowan-Midland*, were very low (1-5 ngg^{-1} dry weight) and remained essentially constant throughout the 1-year sampling period. No significant accumulations of aliphatic or aromatic hydrocarbons in the sediments within the immediate vicinity of the rig were detected.

Evidence of biogenic and petrogenic hydrocarbons was found in several natural depositional regimes around the periphery of Georges Bank; however, the concentration levels (aromatics: 5-20 ngg^{-1}) and chemical composition of these materials were not found to have changed appreciably after drilling began. Furthermore, they were similar to measurements recorded during the 1977 Georges Bank Benchmark Program.

There was no evidence of drilling fluid-related hydrocarbon accumulation in the epifaunal tissues analyzed. Trace metal concentrations in the two Georges Bank species (*Arctica islandica* and *Paralichthys oblongus*) were uniformly low for all elements, indicating no elevation above natural background levels.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-29/29190
CT2-07/29192
IA2-18/29194
CT5-29/29169
30001
20025
30153

MMS CONTRACT NO. 14-12-0001-30001

TITLE: Georges Bank Monitoring Program: Analysis of Hydrocarbons in Bottom Sediments and Analysis of Hydrocarbons and Trace Metals in the Benthic Fauna, Years 2-3

DATE: 31 January 1983 - March 1985

COST: $275,125 - $376,695 (Estimated Range)

PRIME CONTRACTOR:

Science Applications, Inc. (SAI)
Division of Environmental Chemistry and Geochemistry
476 Prospect Street
La Jolla, California 92308

CHARTERED RESEARCH VESSELS:
(see Contract No. 29192)

PROGRAM MANAGER:
James R. Payne

PRINCIPAL PARTICIPANTS:
James R. Payne

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR:
Jeffrey L. Hyland
Rosalind E. Cohen
Alyce T. Fritz

OBJECTIVES:
This study is part of the Georges Bank Monitoring Program. Specific objectives of this study are to:

1. Determine pre-drilling levels and distribution of hydrocarbons in bottom sediments throughout the Georges Bank Lease Sale 42 area.

2. Monitor potential changes in sediment hydrocarbon levels with time, and determine whether these changes are related to oil and gas drilling discharge activities and predicted patterns of dispersion from the drill sites.

3. Identify areas of hydrocarbon accumulation within the study area, and estimate rates of accumulation and release from the sediments.

4. Determine pre-drilling levels of hydrocarbons and trace metals in benthic fauna throughout the Georges Bank Lease Sale 42 area.

5. Monitor potential changes in levels of hydrocarbons and trace metals in benthic fauna, and determine whether these changes are

related to drilling discharge activities and predicted patterns of dispersion from the drill sites.

FINAL REPORT:

Georges Bank Monitoring Program: Analysis of Hydrocarbons in Bottom Sediments and Analysis of Hydrocarbons and Trace Metals in Benthic Fauna During the Second Year of Monitoring (J. R. Payne, J. L. Lembach, R. E. Jordan, C. R. Phillips, G. D. McNabb, M. K. Beckel, G. H. Farmer, R. R. Sims, J. G. Sutton, A. Abasumara; 1983)

Georges Bank Monitoring Program: Analysis of Hydrocarbons in Bottom Sediments and Analysis of Hydrocarbons and Trace Metals in Benthic Fauna During the Third Year of Monitoring (J.R. Payne, J.L. Lambach, G.H. Farmer, C.R. Phillips, M.K. Beckel, J.G. Sutton, and R.R. Sims, Jr.; 1985)

AVAILABILITY:

Available from NTIS:
Final Report - Second Year - PB84141449
Final Report - Third Year -

SUMMARY:

Second year results: Aromatic hydrocarbons, as measured by UV/Fluorescence, were present in low (100 ngg^{-1} dry weight) concentrations in sediments immediately around the drill rig, *Rowan Midland*, before drilling was initiated. Approximately 2 months after drilling began, an apparent increase in sediment aromatic hydrocarbons occurred immediately around the rig; concentrations approaching 400 ngg^{-1} dry weight were observed 5 to 6 months after the onset of drilling, and remained fairly constant for up to 11 months after the drilling was discontinued. Attempts to confirm the presence of drilling fluid components in sediment extracts by FID-GC and GC/MS analyses were inconclusive due to the higher detection limits of these techniques. Several individual polynuclear aromatic hydrocarbons were identified at 1-10 ngg^{-1} dry weight concentrations, but direct correlations with aliphatic and aromatic components in the drilling fluids were not obtained.

Results of UV/Flouresscence analyses at stations further than 2km from the rig indicated no significant changes in aromatic hydrocarbon concentration in the sediments. Evidence of petrogenic hydrocarbons was found in several natural depositional regimes around the periphery of Georges Bank; however, the concentrations and chemical composition of these materials did not change appreciably after drilling began.

There was no evidence of drilling fluid-related hydrocarbon accumulation in the epifaunal tissues analyzed. Trace metal concentrations, including Ba, in two species (*Arctica islandica* and *Paralichthys oblongus*) were uniformly low for all elements.

Third year results: Concentrations of both hydrocarbons in surficial sediments and hydrocarbons and trace metals in tissue were low throughout the Year Three Monitoring Program. Levels of total aromatics in sediments at the site-specific stations were less than 1 ug/g dry weight, and consistent with the base line levels as measured in previous studies. Concentrations of aromatic hydrocarbons at the regional monitoring stations were slightly higher, but also were consistent with the corresponding basement values. Increases in concentrations of total aromatics in sediments at a station 0.5 km from the drilling site concurrent with drilling activities, and the presence of specific petrogenic hydrocarbons in sediment extracts that also were detected during the previous analyses of discharged drilling fluids, provided evidence of short-term deposition of drilling discharge materials in the near-field bottom sediments. Drilling fluid residues were not observed in sediments collected at the station one month after drilling operations were terminated, suggesting relatively short residency times. Furthermore, drilling fluid residues were not observed in sediments from other near-rig or regional stations located at relatively greater distances from the drilling site, either during or subsequent to the drilling activities. No uptake or accumulation of drilling fluid components was detected in tissues of Arctica islandica during the Year Three monitoring program. Hydrocarbon and trace metal burdens in tissues were low, and consistent with corresponding basement and pre-drilling levels.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-69/29190
CT2-07/29192
CT2-33/29198
IA2-18/29194
30025
30153

BLM INTERAGENCY AGREEMENT NO. AA851-IA2-18/MMS INTERAGENCY AGREEMENT NO. 14-12-0001-29194

TITLE: Georges Bank Monitoring Program: Analysis of Trace Metals in Bottom Sediments, Year 1

DATE: 25 March 1982 - 28 June 1983

COST: $324,847

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

CHARTERED RESEARCH VESSELS:
(see Contract No. 29192)

PROGRAM MANAGER:
Michael H. Bothner

PRINCIPAL PARTICIPANTS:
Michael H. Bothner

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Jeffrey L. Hyland

OBJECTIVES:

This study is part of the Georges Bank Monitoring program which is designed to address the following specific questions:

1. What are the quantities, the physical characteristics, and the chemical composition of materials discharged during outer continental shelf (OCS) drilling operations?
2. Where do discharged materials accumulate (e.g., heads of submarine canyons, the "mud patch", around rigs) and in what concentrations?
3. What are the existing background levels of contaminants in the sediments and biota and what levels above background can be detected with existing state-of-the-art technology?
4. Do benthic populations change at selected regions on Georges Bank during various stages of OCS oil and gas activity compared with control sites; can these changes be related to observed changes in the pollutant levels associated with discharges; and what are the concentrations of pollutants associated with these changes?

FINAL REPORT:

The Georges Bank Monitoring Program: Analysis of Trace Metals in Bottom Sediments (M. H. Bothner, R. R. Rendigs, E. Campbell, M. W. Doughten, P. J. Aruscavage, A. F. Dorrzapf, R. G. Johnson, C. M. Parmenter, M. J. Pickering, D. C. Brewster, F. W. Brown; 1982)

AVAILABILITY:

Available from NTIS: Final Report - PB83174888

SUMMARY:

From July 1981, when drilling began on Georges Bank, to May 1982, the concentration of barium increased by a factor of 2.3 at the drill site in Block 312. The post-drilling Ba concentrations were within the range of pre-drilling concentrations measured at other locations on Georges Bank. It was estimated that, based on the first year of analysis, no more than 18 percent of the barite discharged during drilling remained within 6 km of the drill site in Block 312. No drilling-related changes in the concentration of chromium or other metals were observed in bulk sediments from Blocks 410 or 312.

The concentrations of Al, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, V, and Zn in surface sediments of Georges Bank, both before and after drilling, were low compared to average crustal abundances and are characteristic of unpolished coarse-grained sediments as found in other continental shelf areas.

OTHER PUBLICATIONS/REPORTS:

Bothner, M.H., B. Butman, H.S. Bolton, J.L. Hyland, and E. Imamura. 1982. The Georges Bank Monitoring Program: Present and future status (abs.). EOS, Transactions, American Geophysical Union, v. 63, p. 351.

Bothner, M.H., R.R. Rendigs, E. Campbell, M.W. Doughten, P.J. Aruscavage, A.F. Dorrzapf, Jr., R.G. Johnson, C.M. Parmenter, M.J. Pickering, D.C. Brewster, and F.W. Brown. 1983. The Georges Bank monitoring program: Analysis of trace metals in bottom sediments. U.S. Geological Survey Circular 915, 36p.

Butman, B., M.H. Bothner, D.C. Twichell, and D.W. O'Leary. 1982. Present environmental studies of Georges Bank conducted by the U.S. Geological Survey. *In* Workshop Proceedings, Georges Bank energy activity: An update. Center for Ocean Management Studies, University of Rhode Island, p. 26-43.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-69/29190	30001
CT2-07/29192	30025
CT2-33/29198	30153

MMS INTERAGENCY AGREEMENT NO. 14-12-0001-30025

TITLE: Georges Bank Monitoring Program: Analysis of Trace Metals in Bottom Sediments, Year 2

DATE: 5 May 1983 - November 1983

COST: $317,587

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

CHARTERED RESEARCH VESSELS:
(see Contract No. 29192)

PROGRAM MANAGER:
Michael Bothner

PRINCIPAL PARTICIPANTS:
Michael Bothner
Esma Campbell
M. W. Doughten
J. R. Gillison
R. G. Johnson
C. M. Parmenter
M. J. Pickering
B. R. Rendigs

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Jeffrey L. Hyland

OBJECTIVES:
This study is part of the Georges Bank Monitoring Program. Specific objectives of this study were to:

1. Determine pre-drilling levels and distribution of trace metals in bottom sediments throughout the Georges Bank Lease Sale 42 area.

2. Monitor potential changes in trace metal levels with time and determine whether these changes are related to oil and gas drilling discharge activities and predicted patterns of dispersion from the drill sites.

3. Identify areas of trace metal accumulation within the study area, and estimate rates of accumulation and release from the sediments.

FINAL REPORT:

The Georges Bank Monitoring Program: Analysis of Trace Metals in Bottom Sediments During the Second Year of Monitoring (M. H. Bothner, R. R. Rendigs, E. Campbell, M. W. Doughten, C. M. Parmenter, M. J. Pickering, R. G. Johnson, J. R. Gillison; 1983)

AVAILABILITY:

Available from NTIS: Final Report - PB84169465

SUMMARY:

Results of the first and second years of analysis show that:

1. Barium (present as barite in drilling mud) increased by a factor of 5.9 in bulk sediments 200 m from the drill site in Block 410 as a result of drilling. Maximum barium concentration was within the range of pre-drilling concentrations measured at other stations of this program. No drilling-related changes in the concentrations of chromium or other metals were observed in bulk sediments from locations sampled.

2. Twenty-one to thirty-one percent of barite discharged to ocean waters while drilling in Block 312 was in sediments within 6 km of the well 4 weeks after drilling was completed.

3. The inventory of barite, which accumulated as a result of drilling in Block 312, decreased during the period following drilling with a "half-life" of 0.4 years. A decrease in barium concentrations at Block 410 was measured also.

4. Much of the barium not deposited near the drilling rigs was found in the fine fraction of sediment as far as 65 km west of drilling operations.

5. Elevated barium concentrations in bottom sediments were generally within 2 cm of the water/sediment interface.

OTHER PUBLICATIONS/REPORTS:

Bothner, M.H. 1984. Environmental monitoring in Georges Bank: trace-metal analysis of bottom sediment. In Highlights in Marine Research, ed. by S.H. Clarke. U.S. Geological Survey Circular 938, p. 81-89.

Bothner, M.H, R.R. Rendigs, E. Campbell, M.W. Doughten, C.M. Parmenter, M.J. Pickering, R.G. Johnson, and J.R. Gillison. 1983. The Georges Bank monitoring program 1984: Analysis of trace metals in bottom sediments during the second year of monitoring. U.S. Geological Survey Circular 936, 54 pp.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-69/29190
CT2-07/29192
CT2-33/29198
IA2-18/29194
30001
30153

MMS INTERAGENCY AGREEMENT NO. 14-12-0001-30153

TITLE: Georges Bank Monitoring Program: Analysis of Trace Metals in Bottom Sediments, Year 3

DATE: 28 March 1984 - February 1985

COST: $263,824

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

CHARTERED RESEARCH VESSELS:
(see Contract No. 29192)

PROGRAM MANAGER:
Michael H. Bothner

PRINCIPAL PARTICIPANTS:
Michael H. Bothner

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Jeffrey L. Hyland
Rosalind E. Cohen

OBJECTIVES:

This study is part of the Georges Bank Monitoring Program. Specific study objectives are to:

1. Determine pre-drilling levels and distribution of trace metals in bottom sediments throughout the Georges Bank Lease Sale 42 area.

2. Monitor potential changes in trace metal levels with time, and determine whether these changes are related to oil and gas drilling discharge activities and predicted patterns of dispersion from the drill sites.

3. Identify areas of trace metal accumulation within the study area, and estimate rates of accumulation and release from the sediments.

FINAL REPORT:
The Georges Bank Monitoring Program: Analysis of Trace Metals in Bottom Sediments During the Third Year of Monitoring (M. H. Bothner, R. R. Rendigs, E. Y. Campbell, M. W. Doughten, C. M. Pamenter, C. H. O'Dell, G. P. DiLisio, R. G. Johnson, J. R. Gillison, and N. Rait, 1985).

AVAILABILITY:
A review copy is available at the Minerals Management Service, Vienna, Virginia.

SUMMARY:

Barium (present in barite, a major constituent of drilling mud) has increased by a factor of 5.9 in bulk (unfractionated) sediments 200 m from the drill site in block 410 as a result of drilling. The maximum barium concentration (172 ppm) was within the range of predrilling concentrations (28 ppm - 300 ppm) measured at other sampling stations of this program. Because of the low toxicity of barium in the form of barite ($BaSO_4$), no adverse chemical stress to bottom-dwelling organisms is expected from these measured increases in barium concentrations. This prediction is being tested by the biological studies conducted within the Monitoring Program (fig. 8). No drilling-related changes in the concentrations of chromium or of other metals have been observed in bulk sediments from any of the locations sampled in this program.

Of the barite discharged to the ocean waters while drilling in Block 312, it was estimated that 25 percent was present in the sediments within 6 km of the well at the time of the fifth monitoring cruise which was conducted 4 weeks after drilling was completed.

The inventory of barite, which accumulated as a result of drilling in Block 312, has decreased steadily for almost a year during the period following drilling with a "half-life" of 0.34 years. A much slower rate ("half-life" of 3.4 years) is estimated for the period between cruises 8 and 12. At the time of cruise 12, the Ba inventory between 0.5 - 2 km from the well site was approximately 12 percent higher than the predrilling value.

The barite from drilling mud is associated with the fine sediment fraction in low concentrations and is widely distributed. Its fate is closely linked to the energetic sediment transport processes characteristic of this region. Evidence was found for Ba transport and deposition to the west of the drilling activity: at stations 10 and 12 along transect III, at new coring stations 50 km west of transect III, in sediment-trap material and sediments from the head of Lydonia Canyon, and from sediments near the head of Oceanographer Canyon. In addition, peaks were found in the concentraction of Ba with time at upstream control stations 2 and 3, located 35 km northeast of the nearest drilling activity. The data from sediment-trap analyses suggest that barite which is originally deposited near a drill site in this area can be resuspended to at least 25 m above the sea floor.

OTHER PUBLICATIONS/REPORTS:

Bothner, M.H., R.R. Rendigs, E.Y. Campbell, M.W. Doughten, C.M. Parmenter, C.H. O'Dell, G.P. DiLisio, R.G. Johnson, J.R. Gillison, and N. Rait. 1985. The Georges Bank monitoring program: Analysis of trace metals in bottom sediments during the third year of monitoring. U.S. Geological Survey Circular (in press, as of 8/85).

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-69/29190	IA2-18/29194	30025
CT2-07/29192	30001	CT2-33/29198

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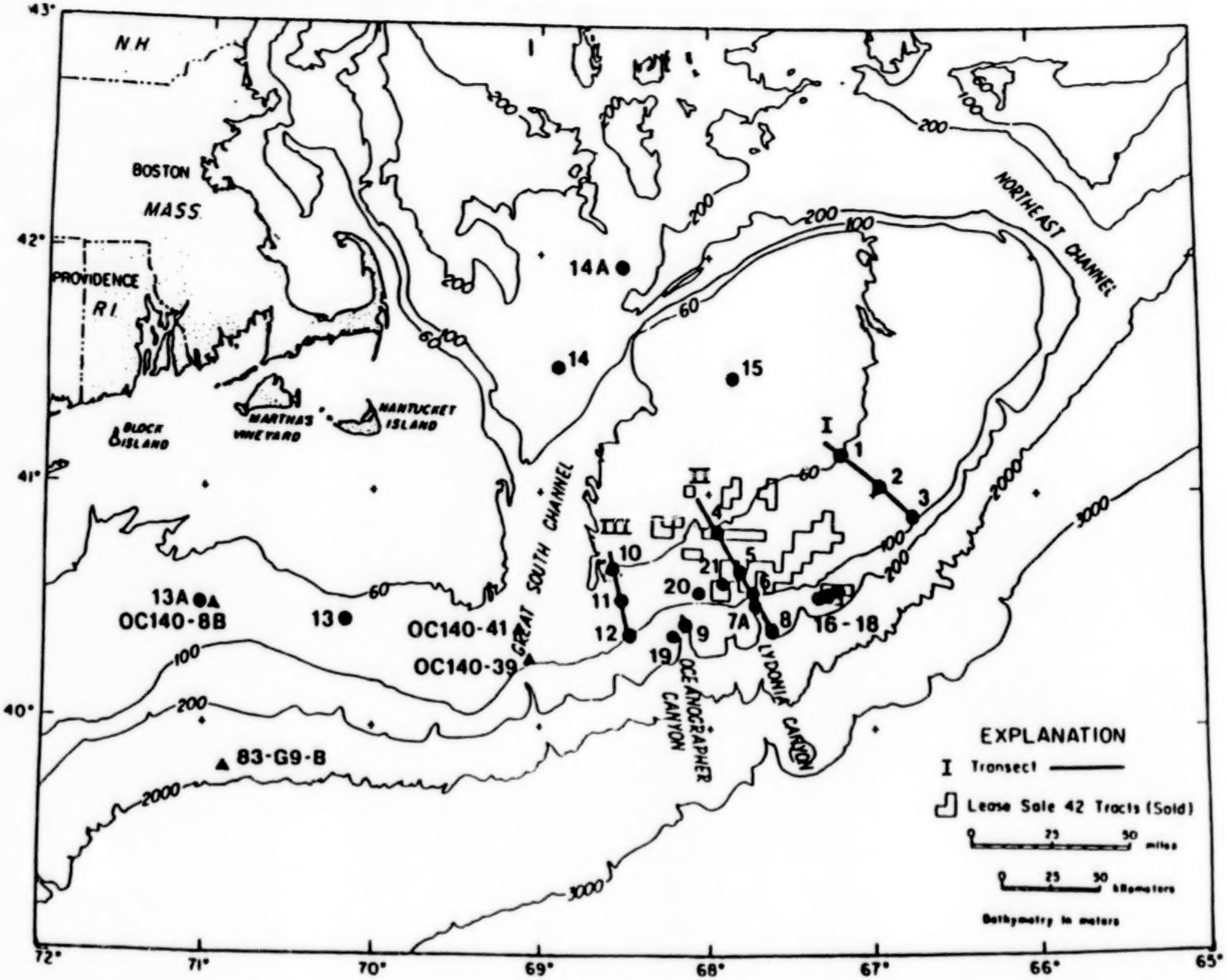

Figure 8. Sampling Stations for the Georges Bank Monitoring Program: Analysis of Trace Metals in Bottom Sediments, Year 3, MMS Interagency Agreement No. 14-12-0001-30153.

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MID-ATLANTIC

Conferences and Workshops

BLM CONTRACT NO. CT5-11

TITLE: Marine Environmental Implications of Offshore Oil and Gas Development in the Baltimore Canyon

DATE: November 1974 - November 1974

COST: $15,000

PRIME CONTRACTOR:

Estuarine Research Federation (ERF)
Virginia Institute of Marine Science (VIMS)
Wachapreague, Virginia 23480

OBJECTIVES:

1. Provide a summary of available related data for a portion of the continental shelf as designated by the Minerals Management Service in the Mid-Atlantic Region.

2. Provide any predictions presently possible of the effects of drilling (including both exploration and exploitation) on the environment of this area.

3. Identify the areas of knowledge in which additional information is essential for reasonable prediction and understanding of the environmental effects of drilling in this area.

4. Formulate recommendations for baseline and monitoring programs adequate for determination of the environmental effects of oil and gas exploration and exploitation in this area.

FINAL REPORT:

Marine Environmental Implications of Offshore Oil and Gas Development in the Baltimore Canyon Region of the Mid-Atlantic Coast (L. E. Cronin, R. E. Smith, co-chairmen, 1974)

AVAILABILITY:

Available from the Contractor.

SUMMARY:

The Mid-Atlantic Conference Workshop was held to review available knowledge of the region, to state the responsibilities of State and Federal Government Agencies, and to recommend the best approach to baseline and monitoring studies, if oil and gas exploration and development should commence in the Mid-Atlantic Region. The workshop recommended that a comprehensive, interdisciplinary study of the region should be conducted prior to oil and gas activities. Workshop comments were also concerned with sampling schemes and sizes, standardization of equipment and methods, data management systems, and analysis of existing published and unpublished data.

MID-ATLANTIC

Environmental Inventories and Assessments

BLM CONTRACT NO. AA550-CT5-42 (VIMS)
BLM INTERAGENCY AGREEMENT NO. 08550-MU5-33 (USGS)

TITLE: Environmental Data Acquistion Analysis - Mid-Atlantic OCS, Year 1

DATE: 17 June 1975 - 16 February 1978 (CT5-42)
12 November 1975 - 5 October 1977 (MU5-33)

COST: $1,547,115 (CT5-42)
$ 961,800 (MU5-33)
$2,508,915

PRIME CONTRACTOR:
Virginia Institute of Marine Science (VIMS)
Gloucester Point, Virginia 23062
U.S. Geological Survey (USGS)
Woods Hole, Massachussetts 02543

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
American University (AU)
The Marine Science Consortium, Inc. (MSC)
University of Delaware (UD)
University of Virginia (UV)

CHARTERED RESEARCH VESSELS:
R/V *James M. Gilliss*

PROGRAM MANAGER:
Maurice P. Lynch (VIMS)
D. W. Folger (USGS)

PRINCIPAL PARTICIPANTS:
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R. Byrne
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M. P. Lynch
W. MacIntrye
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C. Ruddell
E. P. Ruzecki
C. Smith
R. Wetzel

CONTRACTING OFFICER:
William E. Hamm
Frederick M. Galinsky
Paul Lubetkin
A. F. Guida

COR: Jeanne Snider
Arthur Horowitz

OBJECTIVES:
The objectives of the first year field studies conducted by VIMS were to:

1. Collect and analyze chemical and biological data on conditions existing prior to oil and gas development.
2. Assess the processes regulating biological communities.
3. Determine levels of chemical constituents in the shelf environment.

USGS program objectives were to:

1. Identify potential geohazards.
2. Determine sediment movement and probable causes.
3. Describe the minerology.
4. Assess hydrocarbon levels in sediments and section samples.

FINAL REPORT:
Middle Atlantic Outer Continental Shelf Environmental Studies --First Year (M. P. Lynch, D. W. Folger, Program Managers, 1977

AVAILABILITY: Available from NTIS:

Set	- PB281295
Executive Summary (Vol. I)	- PB281296
Final Report (Vol. IIA, Chemical and Biological Benchmark Studies)	- PB281297
Final Report (Vol. IIB, Chemical and Biological Benchmark Studies)	- PB281298
Final Report (Vol. III, Geologic Studies)	- PB281299

SUMMARY:

The Virginia Institute of Marine Science conducted field studies between October 1975 and October 1976 in the Mid-Atlantic (fig. 9). The results of the study indicated: 1) the Mid-Atlantic waters were characterized by three water masses (coastal boundary layer, shelf water, and slope water); 2) eggs and larvae of fishes and crustaceans were significant in the spring neuston; 3) macrobenthos demonstrated little seasonality, and were most dense on the outer shelf; and 4) local ridge and swale topography had a strong influence on the distribution of sediments, on the concentrations of trace metals, hydrocarbons, organic nitrogen, and organic carbon in the sediments, and on the distribution and abundance of the benthic biota.

The U.S. Geological Survey (Woods Hole, Massachusetts) conducted geologic studies on the Mid-Atlantic Outer Continental Shelf (OCS) (Baltimore Canyon Trough Area). The first year results can be summarized: 1) geologic environmental hazards in the area do not warrant withdrawal of lease tracts (Sale 40 area); 2) stress due to waves and currents associated with major storms, bottom sediment mobility, and inherent poor bearing capacity of the sediments may pose problems; and 3) wide-spread dispersal of bottom sediment and suspended matter occurs especially when driven by major storm waves and currents. Recommended studies included determining rates of sediment movement, assessment of the engineering characteristics of the bottom and subbottom, further collection of data on suspended sediment flux, and continuation of monitoring for trace metal and hydrocarbon concentrations.

OTHER PUBLICATIONS/REPORTS:

Bothner, M.H. 1979. Trace metals in surface sediments of the Mid-Atlantic Continental Shelf. U.S. Geological Survey Open-File Report 79-843, 39p.

Butman, B. and D.W. Folger. 1979. An instrument system for long-term sediment transport studies on the Continental Shelf. Journal of Geophysical Research 84:1215-1220.

Butman, B., M.A. Noble, and D.W. Folger. 1977. Observations of bottom sediment movement on the Mid-Atlantic Continental Shelf (abs.). Transactions, American Geophysical Union v. 58, no. 6, p. 408.

Butman, B., M.A. Noble, and D.W. Folger. 1979. Long-term observations of bottom current and bottom sediment transport on the Mid-Atlantic Continental Shelf. Journal of Geophysical Research 84:1187-1205.

Folger, D.W., 1976. Hazards on the Outer Continental Shelf off the Mid-Atlantic states: A preleasing assessment. Association of Engineering Geologists, 19th Annual Meeting Abstracts, p. 17.

Folger, D.W. 1979. Geologic conditions in the Baltimore Canyon Trough area: A summary of USGS first-year environmental studies. U.S. Geological Survey Open-File Report 79-1552, 26 p.

Folger, D.W., H.J. Knebel, and D.C. Twichell. 1976. Ancestral Delaware River Valley: Evidence for cross shelf extention to Wilmington Submarine Canyon (abs.). Geological Society of America, Abstracts with Programs, v. 8, no. 29, p. 175-176.

Hosom, D.S. 1979. The Sea Data 651-4 data logger. Woods Hole Oceanographic Institution Technical Memorandum 6-79.

Hosom, D.S., and B. Butman. 1981. The Sea Data 651-4 data logger. U.S. Geological Survey Open-File Report 81-111, 85 p., 52 figs., 3 tables.

Knebel, H.J., B. Butman, D.W. Folger, P.W. Cousins, and R.R. McGirr. 1976. Maps and graphic data related to geologic hazards in the Baltimore Canyon Trough area. U.S. Geological Survey Miscellaneous Field Studies Map MF-828, 3 sheets.

Knebel, H.J. and D.W. Folger. 1976. Large sand waves on the Outer Continental shelf around Wilmington Canyon, off eastern United States. Marine Geology 22:M7-M15.

Knebel, H.J. and D.W. Folger. 1976. Large sand waves on the Outer Continental shelf around Wilmington Canyon (abs.). Transactions, American Geophysical Union, v. 57, no. 4, p. 268.

Knebel, H.J. and N.S. Hardin. 1975. The responsibilities and environmental programs of the U.S. Geological Survey in the Baltimore Canyon Trough area. Proceedings Outer Continental Shelf Conference and Workshop, College Park, MD, p. 7-17.

Knebel, H.J., C.W. Poag, and E.C. Spiker. 1976. Shallow subbottom stratigraphy, Middle Atlantic Outer Continental Shelf (abs.). Geological Society of America, Abstracts with Programs, v. 8, no. 6, p. 957-958.

Knebel, H.J. and E. Spiker. 1977. Thickness and age of the surficial sand sheet, Baltimore Canyon Trough area. American Association of Petroleum Geologists Bulletin 61:861-871.

Knebel, H.J. and D.C. Twichell. 1978. Heavy-mineral variability in the Baltimore Canyon Trough area. U.S. Geological Survey, Journal of Research 6:215-219.

Mattick, R.E., D.W. Folger, N.T. Foley, G.H. Dolton, and K.C. Bayer. 1976. Summary report of the sediments, structural framework, petroleum potential, environmental conditions, geotechnical considerations of the United States Mid-Atlantic Continental Shelf. U.S. Geological Survey Open-File Report 76-532, 26 p., 4 figs.

Miller, R.E. and D.M. Schultz. 1977. Hydrocarbons in surface sediments of Mid-Atlantic Continental Shelf region—initial survey (abs.). American Association of Petroleum Geologists Bulletin 61(5):814-815.

Sheridan, R.E. and H.J. Knebel. 1976. Evidence for post-Pleistocene faults of the New Jersey Atlantic Outer Continental Shelf. American Association of Petroleum Geologists Bulletin 60:1112-1117.

Twichell, D.C., H.J. Knebel, and D.W. Folger. 1977. Delaware River: Evidence for its former extention to Wilmington Submarine Canyon. Science 195:483-485.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

MU0-16/29175
MU0-18/29175
IA1-15/29183
IA1-17/29184
IA2-26/29196
CT6-62 & MU7-31
MU6-29
MU6-56
MU8-13
MU8-21
MU8-24
MU9-04
MU9-08/29166

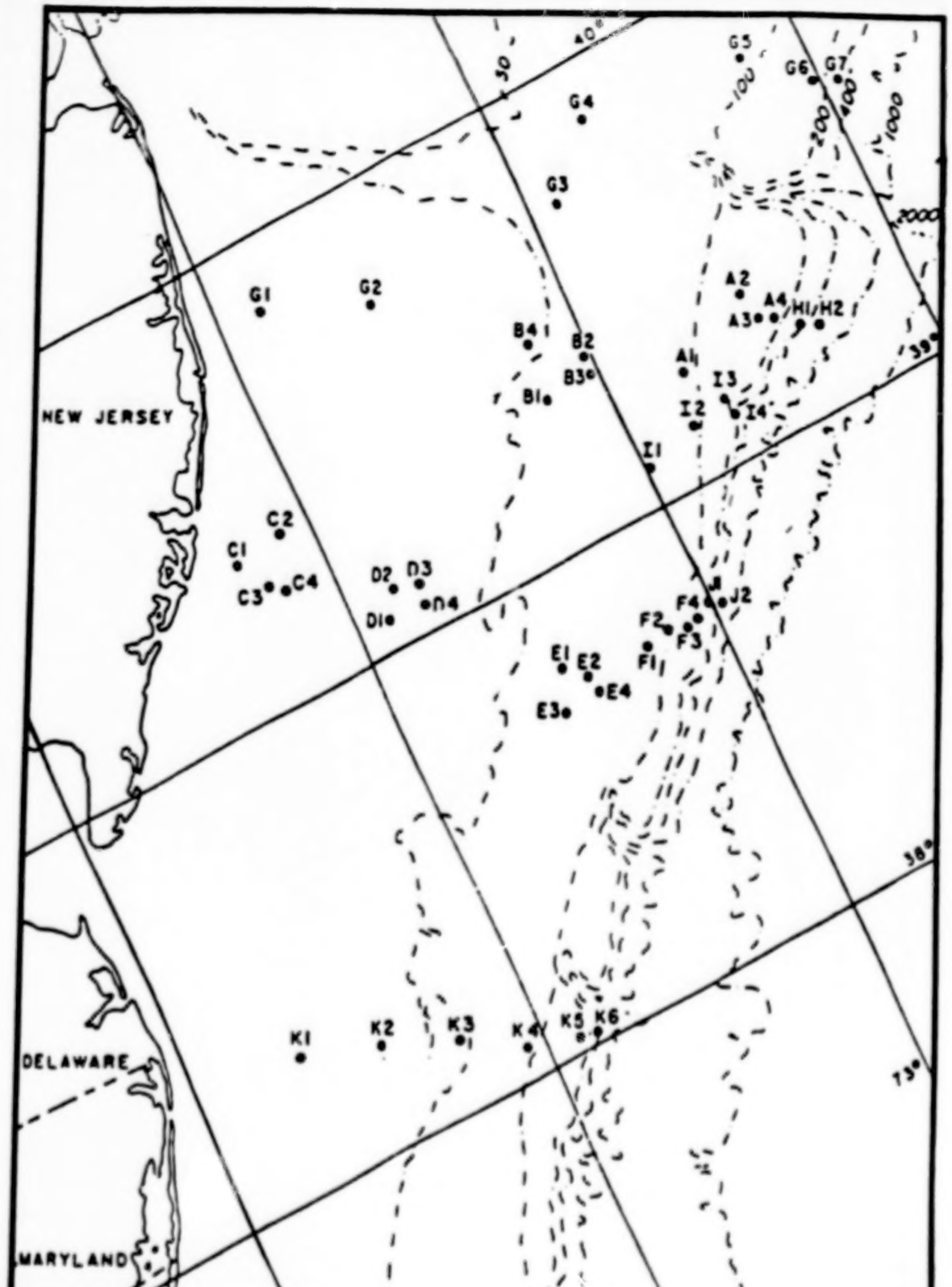

Figure 9. Stations sampled for macrobenthos under Contract Number CT5-42.

BLM CONTRACT NO. AA550-CT6-62 (VIMS)
BLM INTERAGENCY AGREEMENT NO. AA550-MU7-31 (USGS)

TITLE: Environmental Data Acquisition Analysis--Mid-Atlantic OCS,
Year 2

DATE: 30 September 1976 - 22 February 1980 (CT6-62)
26 July 1977 - 24 October 1978 (MU7-31)

COST: $3,210,460 (CT6-62)
$ 994,730 (MU7-31)
$4,205,190

PRIME CONTRACTOR:
Virginia Institute of Marine Science (VIMS)
Gloucester Point, Virginia 23062
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts, 02543

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
American University (AU)
University of Delaware (UD)
University of Virginia (UV)

CHARTERED RESEARCH VESSELS:
R/V Cape Henlopen

PROGRAM MANAGER:
Maurice P. Lynch (VIMS)
Eugene M. Burreson (VIMS)
H. J. Knebel (USGS)

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J. Jacobson
H. Kator
M. Lynch
W. MacIntyre
J. Musick
W. Roller
G. Ruddell
E. Ruzecki
C. Smith
R. Wetzel

CONTRACTING OFFICER:
Paul Lubetkin
F. M. Galinsky
Carroll D. Day

COR: Arthur J. Horowitz
J. Philip Thomas

OBJECTIVES:
The objectives of the second year field studies conducted by VIMS were to:

1. Collect and analyze chemical and biological data on conditions existing prior to oil and gas development.
2. Assess the processes regulating biological communities.
3. Determine levels of chemical constituents in the shelf environments.

The second year study by U.S. Geological Survey was a continuation of the first year's work (summaries for AA550-CT5-42 and 08550-MU5-33). General objectives were to:

1. Measure the rate of sediment mobility over the seabed and monitor resultant changes in bottom concentrations.

2. Evaluate the geotechnical properties of bottom and subbottom sediments and their potential hazard to oil and gas development.

3. Determine the concentration, distribution, and flux of suspended particulate matter in the water column.

4. Determine the nature and distribution of high molecular weight hydrocarbons in the near-surface sediments at selected locations.

FINAL REPORT:

Middle Atlantic Outer Continental Shelf Environmental Studies - Second Year (VIMS, USGS, 1979)

AVAILABILITY:

Available from NTIS:

Executive Summary	(Vol. I) - PB81174740
Final Report	(Vol. IIA, Chemistry & Biology) - PB81174757
Final Report	(Vol. IIB, Chemistry & Biology) - PB81174765
Final Report	(Vol. IIC, Chemistry & Biology) - PB81174773
Final Report	(Vol. IID, Chemistry & Biology) - PB81174781
Final Report	(Vol. III, Geology) - PB81174799

SUMMARY:

The second year study by Virginia Institute of Marine Science was a continuation of the first year's work. New tasks were initiated which focused on the processes controlling benthic communities and finfish distributions. The report synthesized the data from both years of sampling. The results of both years can be summarized: 1) the Mid-Atlantic waters were characterized by three water masses (coastal boundary layer, shelf water, and slope water); 2) eggs and larvae of fishes and crustaceans were abundant in the spring neuston collections; 3) macrobenthos demonstrated little seasonality and were most dense on the outer shelf; 4) local ridge and swale topography strongly influenced the distributions of sediments, chemical constituents in the sediments, and the benthic biota; 5) predation by demersal fish and epibenthic invertebrates is one factor which controls population levels of certain benthic species; and 6) local ridge swale topography had little effect on the distribution of highly mobile demersal fishes. The second year study also found that the recovery rate of a benthic community following a catastrophe is not simply a function of maturation time or longevity.

The second year of study by USGS can be summarized as follows:

1) geologic environmental hazards in the area do not warrant withdrawal of lease tracts, or preclude petroleum exploration or development on the shelf; and 2) the probability of structural failures will be greater during major winter storms or hurricanes. Recommended studies include continuing observations of currents and bottom conditions, assessing the kinds and amounts of suspended matter in the water column, determining the rates and depths of bottom sediment mixing, and identification and mapping of slumping and potential slump hazards on the upper continental slope.

OTHER PUBLICATIONS/REPORTS:

Baker, D.C. and D.S. Fenstermacher. 1978. A hydrocast bottom-finding switch with audible alarm. I.E.E.E. J. of Oceanic Eng. OE3:72-74.

Bertelsen, R.D. and D.P. Weston. In Press. A new species of Sclerobregma (Polychaeta:Scalibregmidae) from off the southeastern United States. Proc. Biol. Soc. Wash.

Bieri, R.H., M.K. Cueman, C.L. Smith and C. Su. 1978. Polynuclear aromatic and polycyclic aliphatic hydrocarbons in sediments from the Atlantic Outer Continental Shelf. Inter. J. Environ. Anal. Chem. 5:293-310.

Boesch, D.F. In Press. Ecosystem consequences of alteration of benthic community structure and function in the New York Bight region. In: Ecological Stress and the New York Bight, ed. by G.F. Mayer. Science and Management. Academic Press, New York.

Boesch, D.F. and R. Rosenberg. In Press. Response to stress in marine benthic communities. In Stress Effects on Natural Ecosystems, ed. by G.M. Barrnet and R. Rosenbert. John Wiley, New York.

Bowen, M.A., P.O. Smith, D.F. Boesch, and J. Van Montfrans. 1979. Comparative biogeography of benthic macrocrustaceans of the Middle Atlantic (U.S.A.) Continental Shelf. Bull. Biol. Sci. Wash. 3:214-255.

Butman, B., D.W. Folger, and M. Noble. 1976. Winter sediment mobility on the Atlantic Outer Continental Shelf. Geological Society of America, Abstracts with Programs, v. 8, p. 779.

Hosom, D.S., and K.W. Doherty. 1979. A water sampling system for a long deployment monitoring system. Woods Hole Oceanographic Institution Technical Memorandum No. 4-79, 140pp.

Karaman, G.S. 1979. Two new species of the genus *Idunella* Sars 1895 (Crustacea:Amphipoda) with remarks on the other species. Proc. Biol. Soc. Wash. 92:75-83.

Kensley, B. 1978. A new genus and species of anthurid isopod from deep water off the east coast of the United States. Proc. Biol. Soc. Wash. 91:558-562.

Knebel, H.J. 1978. Geologic conditions in the Baltimore Canyon Trough Area: A summary of USGS second year environmental studies. U.S. Geological Survey Open-File Report 78-921, 33p.

Knebel, H.J. 1981. Processes controlling the characteristics of the surficial sand sheet, U.S. Atlantic Outer Continental Shelf. Marine Geology 42:349-368.

Knebel, H.J. 1981. Processes controlling the characteristics of the surficial sand sheet, U.S. Atlantic Outer Continental Shelf, *In* Sedimentary Dynamics of Continental Shelves, ed. by C.A. Nittrouer. Developments in Sedimentology 32, Amsterdam, Elsevier, pp. 349-368.

Kornicker, L.S. 1978. *Harbansus*, a new genus of marine ostracoda, and a revision of the Philomedidae (Myodocopina). Smithsonian Contr. Zool. 260, 75p.

LaGatta, D.P., K. Dalenberg, H.J. Knebel, and D.A. Sangrey. 1978. Report on laboratory testing of shallow sediments of Middle Atlantic Outer Continental Shelf. U.S. Geological Survey Open-File Report 78-578, 249p.

Maccubbin, A.E. and H. Kator. 1979. Distribution, abundance, and petroleum-degrading potential of marine bacteria from middle Atlantic continental shelf waters. *In*: Microbial Degradation of Pollutants in Marine Environments. EPA-600/9-79-012.

Olney, J.E. and D.F. Markle. 1979. Description and occurrence of vexillifer larvae of *Echiodon* (Pisces:Carapidae) in the western North Atlantic and notes on other carapid vexillifers. Bulletin of Marine Science 29:365-379.

Olney, J.E. and A. Naplin, 1980. Eggs of the scalloped ribbonfish, *Zu cristatus* (Pisces:Trachiperidae) in the western North Atlantic. Copeia 198:165-166.

Poag, C.W., H.J. Knebel, and R.E. Todd, 1980. Distribution of modern benthic foraminifers on the New Jersey Outer Continental Shelf. Marine Micropaleontology 5:43-69.

Smyth, P.O., In Press. *Callinectes* larvae in surface and subsurface collections in the Middle Atlantic Bight, 1975-1977. NOAA Fish. Bull.

Vecchione, M., 1978. Larval development of *Illex* Steenstrup, 1880, in the northwestern Atlantic with comments on *Illex* larval distributions. Proc. Biol. Soc. Wash. 91:1060-1075.

Welch, C.S., In Press. Mid-level intrusions at the continental shelf edge. J. Geoph. Res., Oceans and Atmos.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

- MU0-16/29175
- MU0-18/29175
- IA1-15/29183
- IA1-17/29184
- IA2-26/29196
- CT5-42 & MU5-33
- MU6-29
- MU6-56
- MU8-13
- MU8-21
- MU8-24
- MU9-04
- MU9-08/29166

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MID-ATLANTIC

Socio-Economic Studies

BLM CONTRACT NO. CT6-01

TITLE: Evaluation of Regional Economic Effects of Offshore Oil and Gas Production in Mid-Atlantic OCS - Harris Model

DATE: August 1975 - 1976

COST: $2,500

PRIME CONTRACTOR:

International Research and Technology Corporation (IRT)
McLean, Virginia 22102

OBJECTIVE:

The objective was to determine the environmental impact of onshore activity from offshore oil and gas development in four New Jersey coastal counties.

FINAL REPORT:

Environmental Consequences of Onshore Activity in Four New Jersey Coastal Counties Resulting from Offshore Oil Development (M. N. Kramer, S. Ratick, A. Watson; 1975)

AVAILABILITY:

Available from NTIS: Final Report - PB249349

SUMMARY:

Results of this study were as follows:

1. Sulfur oxide emission could increase to a level producing a significant deterioration of air quality if stringent sulfur removal controls are not placed on gas processing plants. Other air emissions are not likely to increase enough to warrant serious concern.

2. Point source water emissions are not likely to increase significantly as a result of the onshore impact of offshore drilling.

3. Run-off from construction may be significant. More information is needed to evaluate this impact.

The Strategic Environmental Assessment System and Harris models were extremely useful in providing the basis for performing this environmental assessment. However, other source materials and careful analyses were required to provide meaningful interpretation of the results of the models.

BLM CONTRACT NO. AA851-CT2-25/MMS CONTRACT NO. 14-12-0001-29195

TITLE: Environmental Impacts of Utilizing Pipeline Corridors in the Mid-Atlantic

DATE: 9 April 1982 - 20 December 1983

COST: $150,000

PRIME CONTRACTOR:

Policy Planning & Evaluation, Inc. (PPE)
8301 Greensboro Drive, Suite 460
McLean, Virginia 22102

SUBCONTRACTORS/COOPERATING INSTITUTIONS:

Center for Coastal and Environmental Studies of Rutgers University (CCES)

PROGRAM MANAGER:

James Brosius

PRINCIPAL PARTICIPANTS:

Norbert Psuty
Christopher Talbut

CONTRACTING OFFICER:

Jeffrey P. Petrino

COR: Neville Chow

OBJECTIVES:

1. Compile information on the potential hazards of pipeline emplacement in the Mid-Atlantic on the biological and cultural resources in the region.

2. Develop maps of these hazards and resources depicting their spatial and temporal location, including a composite map depicting the relative risk to pipeline emplacement within discrete areas.

3. Document data sources for the maps, and provide supporting text assessing relative hazards/impacts of specific factors or regions to pipeline emplacement and suggesting measures to eliminate or alleviate these hazards/impacts.

FINAL REPORT:

Identification and Assessment of Impacts Associated with the Construction and Operation of Submarine Pipelines on the Mid-Atlantic Outer Continental Shelf (J. E. Brosius, C. W. Talbot, N. P. Psuty; 1983)

AVAILABILITY:

Available from NTIS: Final Report - PB84187863

SUMMARY:

This study was designed to identify and assess the range and magnitude of potential impacts associated with the construction and operation of submarine pipelines in the outer continental shelf (OCS) of the Mid-Atlantic Region. The study will be used in the pipeline-siting process and will serve as a source document for the Minerals Management Service in pre- and post lease sale decision making.

In order to ensure that pipelines are constructed in a safe manner and designed to operate safely over their projected lifetime with minimal disruption of the marine environment, it was necessary to assess the suitability of areas for pipeline construction. This assessment was accomplished by characterizing and inventorying the geologic, biologic, and cultural/economic features of the Mid-Atlantic OCS where pipelines might be sited. The characterization was followed by an investigation of potential impacts associated with pipeline construction and operation, based on experiences in other areas.

Finally, an assessment of the probable impacts associated with the specific features of the Mid-Atlantic OCS was undertaken, and was given a value of HIGH, MODERATE, LOW, or SPECIAL CASE reflecting the impact potential associated with it.

It was found that relatively few HIGH impact areas exist in the study area, but a number of mitigating measures and special practices are needed to minimize impacts which may occur in other areas. Specific areas which should be avoided include certain dumpsites, a marine sanctuary, an area of surf clams off Atlantic City, New Jersey, and canyons and canyon heads. In the remaining areas, the adoption of special stipulations involving the engineering and design of the pipeline, and the coordination of activities between the pipeline industry and other resource users, in addition to standard industry procedures, are required to ensure safe development and operation of the pipeline.

This report is based on the best available knowledge describing pipeline impacts in other areas. Therefore, the findings of the study are limited by the problem of applying information from one geographic area to activities in another. Further, the report describes impacts associated with one pipeline, and does not reflect the cumulative impacts which might result from several pipelines.

MID-ALTANTIC

Geology/Chemistry

BLM INTERAGENCY AGREEMENT NO. AA551-MU8-21

TITLE: Mid-Atlantic Geologic Studies, Year 3

DATE: 16 June 1978 - 15 May 1979

COST: $848,898

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Woods Hole Oceanographic Institution (WHOI)

CHARTERED RESEARCH VESSELS:
R/V *Atlantis* II
R/V *Columbus Iselin*
R/V *Endeavor*
R/V *Gillis*
R/V *Gyre*
R/V *Oceanus*

PROGRAM MANAGER:
James M. Robb

PRINCIPAL PARTICIPANTS:
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Michael H. Bothner
Bradford Butman
Harley J. Knebel
R. E. Miller
John A. Moody
James M. Robb
Richard A. Slater

CONTRACTING OFFICER:
Paul Lubetkin
Carroll D. Day

COR: Arthur Horowitz
Eiji Imamura

OBJECTIVES:

1. Estimate the extent and rate of sediment mobility over the seabed and monitor resultant changes in bottom morphology and texture.

2. Identify major processes causing sediment movement and assess seasonal variability.

3. Complete a study of suspended particulate matter in the water column that was begun under a previous Memorandum of Understanding.

4. Determine the rates and depths of sediment mixing in Sale 40 and Sale 49 lease areas as an aid to predicting the fate of spilled hydrocarbons, drilling chemicals, and drill cuttings.

5. Identify and map areas of slumping or of potential slumping hazard in lease areas on the continental slope.

6. Identify and study the effects of processes and mechanisms contributing to sediment instability in offshore lease areas which may lead to inception of slumping and sliding.

7. Assess the geotechnical properties of sediments in the continental slope lease areas.

8. Determine potential geologic hazards in nearshore areas.

FINAL REPORT:

Environmental Geologic Studies in the Mid-Atlantic Outer Continental Shelf Area--Results of 1978-1979 Field Seasons (J. M. Robb, editor, 1982)

AVAILABILITY:

Available from NTIS: Final Report and Executive Summary - PB83147934

SUMMARY:

This and previous studies under BLM/USGS agreements were directed toward characterization of the environments of the Outer Continental Shelf (OCS) - measurements of day-to-day activity of the sea waters and descriptions of those aspects of the sea floor which can tell us what processes have taken place to create and modify it.

Material on the bottom at Continental Shelf depths is stirred up by storms from time to time. Tidal motions are commonly the strongest components of coastal sea-water motions and cause rotary currents, whose velocity vectors trace out ellipses over diurnal periods. On Georges Bank, where tidal currents are strongest southeast and northwest in the onshore and offshore directions, there is a long-term component of water transport toward the southwest. This transport apparently leads to the deposition in the "mud patch," an area south of Martha's Vineyard, of fine-grained material winnowed from Georges Bank. If fine-grained materials are produced by drilling activities, the mud patch may be the site of their eventual accumulation. The amount of material carried southwest from the "mud patch" to the Mid-Atlantic shelf is probably slight but is not determined.

Near Wilmington Canyon, on the southern part of the area of greatest exploration interest in the Mid-Atlantic OCS, Gulf Stream rings (eddies shed from the northeast-flowing Gulf Stream) affect the currents of the outer shelf. The major factor affecting flow in that area is wind stress. In the deeper waters seaward of the Continental Shelf break, bottom currents caused by wind stress are much reduced.

Residence times of material suspended near the bottom in a nepheloid layer (turbid near-bottom waters) were found to be about 5 hours on Georges Bank, 1.3 days in the "mud patch" south of Martha's Vineyard, and 2 days in the Mid-Atlantic Bight region. Such values are low compared to residence times of 1 to 3 months for deep-sea nepheloid layers, and emphasize the relatively dynamic environment of the Continental Shelf area. Once material is deposited on the sea bottom, radioisotope studies (^{210} Pb) show that it may be mixed in to depth of 20 cm within a relatively short time (less than 20 years) by biological activity as well as by wave and current agitation.

On the inner Continental Shelf, a buried valley formerly occupied by the Hudson River was found to extend southward across the shelf from the New York area. Other buried valleys have been found running across the shelf from Delaware Bay and from the Toms River, but the existence of this ancient valley of the Hudson had been previously unknown. Its presence and the sediments transported through it may help to explain the sites and configurations of some submarine canyons along the Continental Slope, as well as the nature of a slightly shallower area along the southern bank of the present Hudson Channel on the Continental Shelf. The buried valley was found to be filled with interbedded sands and muds. Geotechnical tests of the overlying material show that it should not cause problems of stability for future engineering efforts.

Studies on the Continental Slope were primarily directed to determining its stability. Studies using seismic profiles, cores, and submersible dives showed that the slope has a very complex bathymetric surface which has probably remained largely unchanged since the ice age; there were few slump or landslide features found. However, small-scale (1-2 m) slides probably occurred from time to time on some of the steeper slopes, and geotechnical tests did show that some places may be marginally stable. The channelways and lower walls of submarine canyons should probably be viewed with caution as sites for semipermanent structures.

Seismid-reflection profiles along the upper Continental Slope commonly show "turbid zones" or "washouts" attributed to the presence of gas in the sediments. Studies to determine whether gas in the interstices of the sediment could have an effect on stability were largely inconclusive because of necessarily crude sampling techniques and our inablility to determine in-situ pressures and quantities of gas. However, those analyses did show the presence of considerable amounts of hydrocarbon gases in some places, and that some of those gases may by thermogenic, related to deep-seated petroleum deposits in the area.

OTHER PUBLICATIONS/REPORTS:

Knebel, H.J. 1979. Anomalous topography on the Continental Shelf around Hudson Canyon. Marine Geology 33:M67-M75.

Knebel, H.J. 1980. Processes controlling the characteristics of the sand sheet, U.S. Atlantic Outer Continental Shelf (abs.). American Asssociation of Petroleum Geologists Bulletin 64:733.

Knebel, H.J. and B. Carson. 1977. Small-scale slump deposits, Middle Atlantic upper continental slope (abs.). Geological Society of America Abstracts with Programs v. 9, no. 7, pp. 1053-1054.

Knebel, H.J. and B. Carson. 1979. Small scale slump deposits, Middle Atlantic Continental Slope off eastern United States. Marine Geology, 29:221-236.

Knebel, H.J., D.C. Twichell, and J.M. Robb. 1979. Slumping in the intercanyon areas, Middle Atlantic Continental Slope (abs.). American Association of Petroleum Geologists Bulletin 63:480.

Knebel, H.J. and S.A. Wood. 1978. Hudson River: Evidence for extensive migration on the Continental Shelf during Pleistocene (abs.). Geological Society of America, Abstracts with Programs v. 10, no. 7, p. 436.

Knebel, H.J., S.A. Wood, and E.C. Spiker. 1979. Hudson River: Evidence for extensive migration on the exposed Continental Shelf during Pleistocene time. Geology 7:254-258.

Robb, J.M. 1980. High-resolution seismic-reflection profiles collected by R/V COLUMBUS ISELIN, Cruise CI-7807-1, in the Baltimore Canyon Outer Continental Shelf area, offshore New Jersey. U.S. Geological Survey Open-File Report 80-935, 3p.

Robb, J.M., D.C. Twichell, and J.C. Hampson. 1979. Morphology of an intercanyon segment of the continental slope off the Baltimore Canyon OCS region (abs.). Geological Society of America, Abstracts with Programs v. 11, p. 504.

Schlee, J.S., R.E. Mattick, R.B. Powers, J.M. Robb, D.C. Twichell, and B. Butman. 1979. Summary report of the sediments, structural framework, petroleum potential, and environmental conditions of the United States Mid-Atlantic Continental Margin in area of proposed Oil and Gas Lease Sale No. 59. U.S. Geological Survey Open-File Report 79-1351.

Slater, R.A., D.W. Folger, B. Butman, M.H. Bothner, H.J. Knebel, J.M. Aaron, J.M. Robb, and P. Popenoe. 1979. Potential geologic hazards associated with the United States Atlantic Continental Margin. In Offshore geologic hazard short-course notes: Rice University, Houston, Texas, p. 4-1 to 4-48.

Twichell, D.C., J.C. Hampson, and J.M. Robb. 1979. Mass wasting on the Middle Atlantic Continental Slope and upper Rise: A regional perspective (abs.). Geological Society of America,

Abstracts with Programs v. 11, no. 531.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

- MU0-16/29175
- MU0-18/29175
- IA1-15/29183
- IA1-17/29184
- IA2-26/29196
- CT5-42 & MU5-33
- CT6-62 & MU7-31
- MU6-29
- MU6-56
- MU8-13
- MU8-24
- MU9-04
- MU9-08/29166

MID-ATLANTIC

Physical Oceanography

BLM INTERAGENCY AGREEMENT AA550-IA6-12

TITLE: Mid-Atlantic Physical Oceanographic and Meteorological Study

DATE:

COST: $128,000

PRIME CONTRACTOR:
National Oceanic and Atmospheric Administration
Environmental Data Service
Center for Experiment Design and Data Analysis

SUBCONTRACTORS/COOPERATING INSTITUTIONS:

CHARTERED RESEARCH VESSELS:

PROGRAM MANAGER:
Eugene M. Rasmusson

PRINICIPAL PARTICIPANTS:
Robert G. Williams
Fredric A. Godshall

CONTRACTING OFFICER:

COR:

OBJECTIVES:

1. Summarize historical meteorological and oceanographic data for the region.

2. To analyze the historical data summaries.

3. To draw conclusions from the analysis and to recommend design for future field programs to fill existing data gaps.

FINAL REPORT:
Summarization and Interpretation of Historical Physical Oceanographic and Meteorological Information for the Mid-Atlantic Region (NOAA, 1977)

AVAILABILITY:
A review copy is available at the Minerals Management Service, Vienna, Virginia.

SUMMARY:

The surface wind field, which affects the movement of spilled pollutants, as analyzed on the basis of passing-ship, of "Marine Deck," observations is similar to that documented in the literature. The Marine Deck observations are quite adequate for defining major statistical features of the surface wind field, but better estimates of extreme wind speeds and return periods

depend on many more years of wind records or an improved statistical estimation method. Water masses, whose structure and variability are particularly relevant to the dispersion and advection of pollutants, were analyzed. In winter, water temperatures on the shelf are nearly uniform, at 5 to 7°C with a slight increase with depth. Warming begins in late March to April, leading to a weakening of horizontal gradients and the development of a seasonal thermocline, usually located at a depth of 15 to 25 m. Summer temperatures increase somewhat with decreasing latitude, but cold "winter" water still persists. Salinity increases seaward, is highest in winter, and increases with depth in all seasons. Dissolved oxygen concentrations vary seasonally, with the water in the surface layer always being saturated and large vertical differences being found in the midshelf area. Surface currents, which act directly to advect and disperse pollutants, were analyzed from ship-drift data, and current vectors and variability statistics were computed. Seasonal variability was found to be not as pronounced as variability reported in the literature from surface-drifter studies. Vertical mixing is strong in winter, when nearly homogenous water is found from the surface to the bottom. The seasonal wave climatology compiled from visual shipboard observations shows that sea states in the Mid-Atlantic region are maximum in winter and minimum in summer.

OTHER PUBLICATIONS/REPORTS:

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

MMS CONTRACT NO. 14-12-0001-30066

TITLE: Mid-Atlantic Slope and Rise Study (MASARS) - Physical Processes

DATE: 9 September 1983 - September 1986

COST: $2,140,693

PRIME CONTRACTOR:
Science Applications, International Corporation (SAIC)
Admiral's Gate
221 Third Street
Newport, Rhode Island 02840-6669

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Shell Oil Company
U.S. Environmental Protection Agency (EPA)
University of Maryland (UMd)
University of Miami (UM)
University of North Carolina (UNC)
University of Rhode Island (URI)
Woods Hole Oceanographic Institute (WHOI)

CHARTERED RESEARCH VESSELS:
R/V Cape Henlopen
R/V Regent Seahorse

PROGRAM MANAGER:
Mr. Christian Casagrande

PRINCIPAL PARTICIPANTS:
John Bane (UNC)
William Boicourt (UMd)
Otis Brown (UM)
Gabriel Csanady (WHOI)
Robert Evans (UM)
Peter Hamilton (SAI)
Donald Olson (UM)
Randolph Watts (URI)

ADVISORY BOARD:
Glenn Flierl
Christopher Garret
John Walsh

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: James Lane

OBJECTIVES:

1. Determine broad-scale, general circulation features on the continental slope and rise on a seasonal basis.
2. Describe and quantify the variability in these areas in the vertical and horizontal plane.
3. Determine the degree to which the slope/rise circulation features influence the physical oceanography of the Middle Atlantic Continental Shelf (fig. 10 and 11).
4. Determine local currents and sediment distribution around the Block 372 deep-water drillsite.

FINAL REPORT:

Due September, 1986.

AVAILABILITY:

SUMMARY:

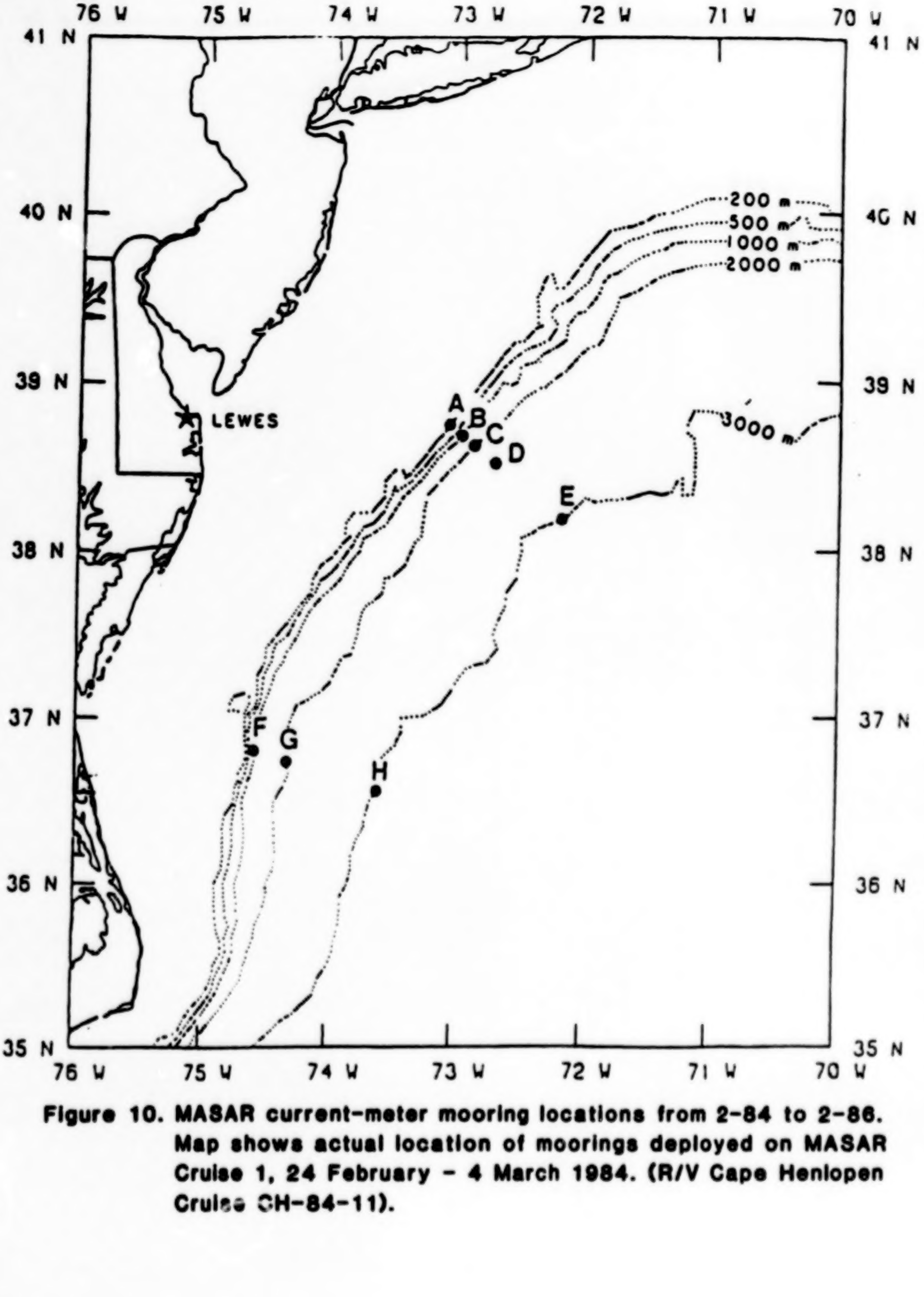

Figure 10. MASAR current-meter mooring locations from 2-84 to 2-86. Map shows actual location of moorings deployed on MASAR Cruise 1, 24 February - 4 March 1984. (R/V Cape Henlopen Cruise CH-84-11).

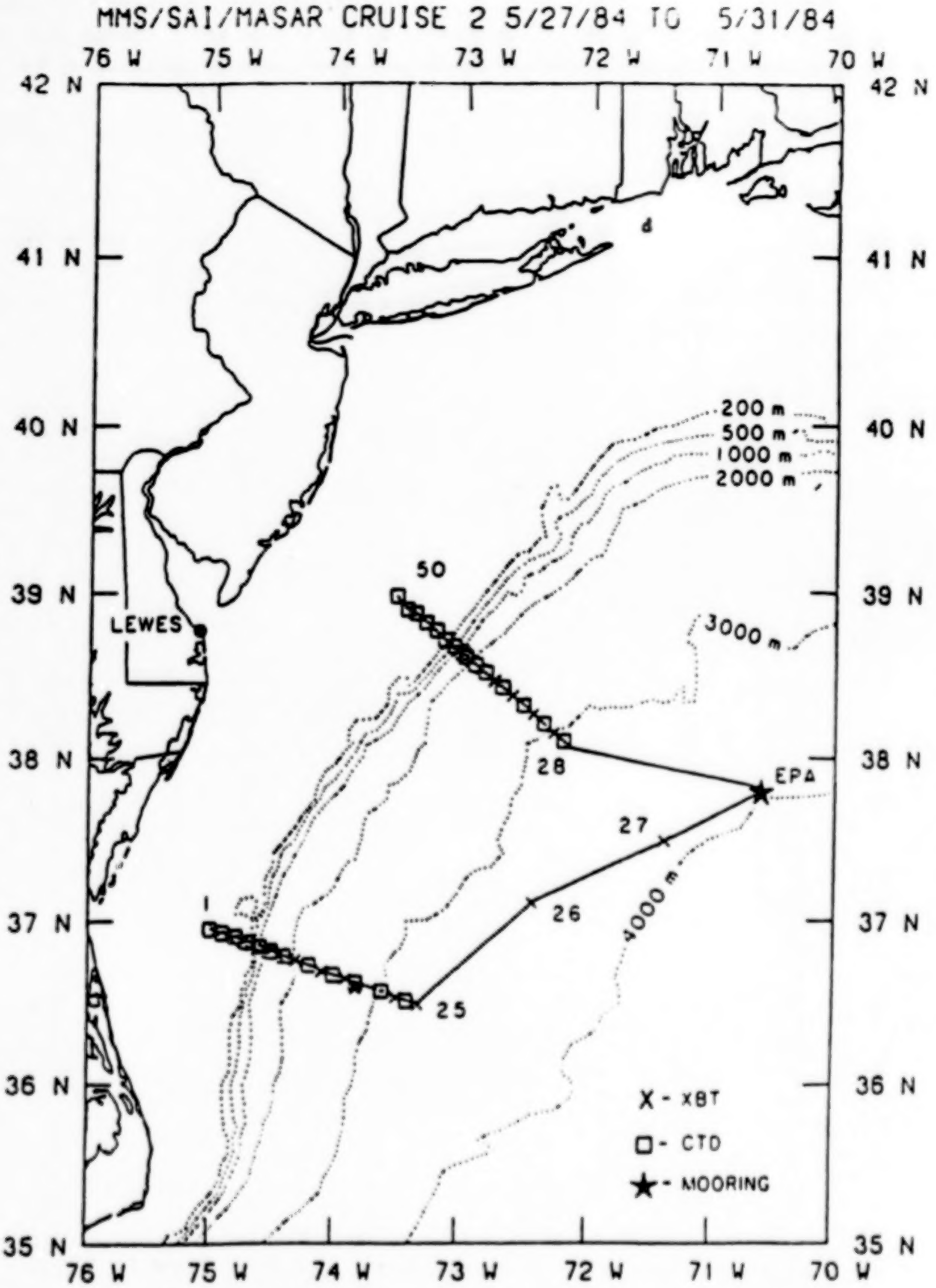

Figure 11. MASAR hydrographic stations sampled at 3-month intervals from 2-84 to 2-86. Map shows actual location of XBT and CTD stations occupied and the EPA mooring site during MASAR Cruise II, 27-31 May, 1984.

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MID-ATLANTIC

Biology

BLM INTERAGENCY AGREEMENT NO. AA550-IA7-35

TITLE: NMFS Middle Atlantic Biological Baseline Studies

DATE: 17 June 1977 - January 1984

COST: $550,000

PRIME CONTRACTOR:
National Marine Fisheries Service (NMFS)
Northeast Fisheries Center
Sandy Hook Laboratory
Highlands, New Jersey 07732

PROGRAM MANAGER:
Robert N. Reid

PRINCIPAL PARTICIPANTS:
Thomas Azarovitz
Elizabeth S. Bevacqua
Charles J. Byrne
Linda I. Despres
Harold A. Foster
Ann B. Frame
Donald G. McMillan
Robert A. Murchelano
David J. Radosh
Aaron Rosenfield
W. G. Smith
Roger B. Theroux
Alice Wells
Thomas E. Wilhelm

CONTRACTING OFFICER:
Paul Lubetkin
Jeffrey P. Petrino

COR: Eiji Imamura
Jeffrey L. Hyland

OBJECTIVES:
The purpose of this study was to support an environmental baseline study of the Mid-Atlantic Outer Continental Shelf (OCS) already initiated by Virginia Institute of Marine Science (VIMS) and U.S. Geological Survey (USGS). Objectives of this study are:

1. Provide summaries, biological analyses, and interpretations of the total data on trawl fisheries for the Mid-Atlantic OCS area.

2. Compile ichthyoplankton data and provide summaries, biological analyses, and interpretations of ichthyoplankton associations and distributions.

3. Provide biological analyses of 114 Baltimore Canyon Trough benthic grab samples, relate the resulting data to sediment type, percent organics, and existing heavy metal burdens, and report on the distribution and abundance of benthic fauna in the Mid-Atlantic Bight with respect to various chemical, geological, and physical parameters.

4. Conduct a bibliographic search, compilation, and documentation of diseases, abnormalities, and environmentally induced stresses of animals that inhabit U.S. waters.

FINAL REPORTS:

1. Distribution and Abundance Trends of 22 Selected Species in the Middle Atlantic Bight from Bottom Trawl Surveys During 1967-1979 (Objective 1) (T.R. Azarovitz, C.J. Byrne, E.S. Pritchard, L.I. Despres-Patanjo, H.A. Foster; 1985)

2. The Distribution and Abundance of Ichthyoplankton in the Middle Atlantic Bight as Determined From Coastal Surveys and Site-Specific Studies, 1965-1976. NMFS Report No. SHL 79-02, (Objective 2) (W.G. Smith, A. Wells, D.G. McMillan; 1979)

3. Benthic Survey of the Baltimore Canyon Trough, May 1974 Final Report. NMFS Report No. SHL 78-8 (Objective 3) (D.J. Radosh, A.B. Frame, T.E. Wilhelm, R.N. Reid; 1978)

4. Diseases of North American Marine Fishes, Crustaceans and Mollusks (Objective 4) (R.A. Murchelano, A. Rosenfeld; 1980)

AVAILABILITY:

Available from NTIS:
Final Report (Objective 1) - PB--------
Final Report (Objective 2) - PB81214785
Final Report (Objective 3) - PB81216020
Final Report (Objective 4) - PB81216038

SUMMARIES:

Report 1 - Distribution plots taken from spring and fall cruise data show that many of the more important finfish species found in the Mid-Atlantic Bight from Cape Cod to Cape Hatteras are not endemic but are seasonal migrants. Because of the absence of a discrete endemic fish fauna zoogeographers have been hesitant to recognize the Mid-Atlantic Bight as a separate faunal province. However, several species, whose distributions were summarized in this report, do have their centers of abundance in the Bight (e.g., summer flounder, windowpane, fourspot flounder, scup). Most individuals in these populations do not leave the Mid-Atlantic Bight, but migrate seasonally and concentrate in narrow bands along the margins of the area. For example, summer flounder concentrate in the inshore areas in summer, but migrate offshore and concentrate on the outer-shelf in the winter. Many of the other species (e.g., bluefish, Atlantic herring, Atlantic mackerel) undergo such extensive seasonal movements that they are virtually absent from the study area during the program's spring and autumn cruises.

Report 2 - This study summarizes ichthyoplankton data collected by the NMFS Sandy Hook Marine Laboratory from the Middle Atlantic Bight between 1965 and 1976. The plankton samples were collected on coastal surveys designed to monitor seasonal shifts in the distribution and abundance of planktonic fishes, and from site-specific studies designed to investigate the vertical distribution and diel movements of selected larvae. The report describes occurrences and seasonal patterns of numerically dominant larvae. All larval fish data from the three surveys are tabulated by station or by cruise. The results showed the seasonal nature of spawning in the Middle Atlantic Bight. In addition, the reports discussed intersurvey comparisons, distribution of fish eggs, community assemblages of larval fish, neuston collections, zooplankton volumes, and diurnal movements of larval fishes in relation to size, circulation, and temperature.

Report 3 - This study analyzed benthic grab samples from two sites in the Baltimore Canyon Trough. Surficial sediments were basically medium to fine sands; heavy metal (Cd, Cr, Cu, Ni, Pb, Zn) concentrations were low or undetectable, and the benthic infauna were dominated by polychaetes and peracarid crustaceans. An assessment of possible impacts from oil-related activities on benthos was also made.

Report 4 - The significant infectious and non-infectious diseases of North American marine fishes and shellfishes were described in terms of host species, geographic range, gross lesions, etiology, method of diagnosis, and prognosis. Infectious diseases of fish and shellfish are caused by viruses, bacteria, fungi, protozoa, and metazoa. The non-infectious diseases discussed included those caused by aflatoxin, chlorine, gas bubbles, heavy metals, pesticides, and petroleum. Narrative sections explained the significance and importance of these diseases. The major genera of marine fishes and shellfishes and the major groups of infectious and non-infectious diseases included in the bibliography were tabulated. A glossary of terms used in the indices of infectious and non-infectious diseases of fish and shellfish was also included.

BLM CONTRACT NO. AA551-CT8-32

TITLE: Benthic Recolonization Study under Simulated Oil Spill Conditions in the Mid-Atlantic OCS Area

DATE: 26 September 1978 - 9 January 1981

COST: $3,629,823

PRIME CONTRACTOR:
Virginia Institute of Marine Science (VIMS)
College of William and Mary
Gloucester Point, Virginia 23062

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Advex Corporation
American University (AU)
Louisiana State University (LSU)
University of Virginia (UV)

CHARTERED RESEARCH VESSELS:
R/V Cape Henlopen

PROGRAM MANAGER:
Eugene M. Burreson

PRINCIPAL PARTICIPANTS:
D. F. Boesch
Michael Champ (AU)
Howard I. Kator
Craig L. Smith

CONTRACTING OFFICER:
A. F. Guida
Carroll D. Day

COR: J. Philip Thomas
William H. Lang

OBJECTIVES:

The study consists of two phases: phase one, the development of a surface activated deployment and recovery system (SADRS) which contains recolonization boxes; phase two, deployment and recovery of the SADRS with actual recolonization experiments. The objectives of phase two were to:

1. Determine the sequence of benthic recolonization in the event of a pollution event.

2. Estimate the length of time necessary for a return to pre-pollution event populations (both numbers of species and species composition).

3. Determine the chemical changes in oil over time.

4. Develop predictive recolonization models for the major physiographic provinces of the Mid-Atlantic through the judicious siting of the recolonization experiments.

FINAL REPORT:

Experimental Colonization of Crude Oil Contaminated Sediments by Benthos on the Middle Atlantic Continental Shelf (D. F. Boesch, E. M. Burreson, L. C. Schaffner, H. I. Kator, C. L. Smith, D. M. Alongi, M. A. Brown, P. O. deFur; 1981)

AVAILABILITY:

Available from NTIS: Final Report - PB81223570.

SUMMARY:

In August 1979 six arrays of defaunated sediment were deployed at each of three sites on the Middle Atlantic Outer Continental Shelf. Three arrays at each site had Prudhoe Bay crude oil mixed with the sediment. Because of technical difficulties, recovery was limited to one control and one oiled array from two sites--one near the shelf break and one in a mid-shelf swale--after 10 months in situ. Moderate to severe sediment erosion occurred in boxes recovered from the mid-shelf. Chemical analyses indicated that between 50 and 90 percent of the added oil remained in the sediments after 10 months and also that the oil was qualitatively similar to the added oil. Relatively more oil was retained in the muddy sands near the shelf break than in the mid-shelf fine sands. Generally, there was no demonstrable effect of Prudhoe Bay crude oil contamination on colonization by either macrobenthos or meiobenthos, although at the shelf break certain species were less successful in colonization of the oiled boxes. Results are consistent with the hypothesis that less frequently disturbed finer grained habitats are more susceptible and sensitive to oil contamination.

MMS PURCHASE ORDER NO. 10244

TITLE: Effects of a Natural Disturbance on a Continental Shelf Live Bottom Community

DATE: 12 December 1984 - October 1985

COST: $9,995

PRIME CONTRACTOR:
Duke Univeristy (DU) Marine Laboratory
Beaufort, North Carolina 28516

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
University of North Carolina (UNC)
East Carolina University (ECU)
North Carolina Division of Marine Fisheries (NC)

CHARTERED RESEARCH VESSELS:
R/V Cape Hatteras

PROGRAM MANAGER:
William W. Kirby-Smith

PRINCIPAL PARTICIPANTS:
Dr. William W. Kirby-Smith (DU)
Dr. Larry Cahoon (UNC)
Mr. T. Boyton (UNC)
Mr. W. Sutherland (UNC)
Dr. Stan Riggs (ECU)
Dr. Joseph Ustach (DU)
Dr. T. Johnson
Steve W. Ross (NC)

CONTRACTING OFFICER:
Stephanie E. Innello

COTR: Timothy F. Sullivan

OBJECTIVES:
Determine the impact of a hurricane on a midshelf live-bottom community.

FINAL REPORT: Effects of a Natural Disturbance on a Continental Shelf Live Bottom Community off North Carolina.

AVAILABILITY: A review copy is available at the Minerals Management Service, Vienna, Virginia.

SUMMARY:

Hurricane Diana was a major storm which would have been expected to cause significant damage to live bottom communities on the mid continental shelf in the area near where the storm passed. The effects off Cape Fear shoals were expected to be particularly severe given that the storm was stalled in the vicinity for more than 24 hours. Biological sampling using 35 mm slides and TV transects revealed no quantitatively significant differences in live bottom communities between pre and post hurricane samples which could be attributed to the hurricane. Damage observed which was probably hurricane-related was limited to observations of dead mussels, some dead corals and necrotic spots on corals. Geological sampling revealed no effects of hurricane Diana in terms of erosion of ledges or sedimentary profiles. Coral heads appeared to have been damaged but not destroyed. These data suggest that mid-continental shelf live bottom communities are not significantly damaged by wave energy and sediment scour associated with the passage of a major storm. Thus it would appear temporary disturbance of the in situ sediment is not likely to have a severe or lasting impact on these communities and that communities are adapted to periodic sand scour and sediment movement.

OTHER PUBLICATIONS:

RELATED CONTRACTS:
CT9-27 CT1-18

SOUTH ATLANTIC

Conferences and Workshops

BLM CONTRACT NO. AA550-CT6-05

TITLE: South Atlantic OCS Studies Conference

DATE: August 1975 -

COST: $39,000

PRIME CONTRACTOR:

Research Triangle Institute (RTI)
P.O. Box 12194
Research Triangle Park, North Carolina 27709

OBJECTIVES:
The overall objectives of this conference/workshop were fourfold:

1. Provide a summary of available related information and understanding for the South Atlantic Outer Continental Shelf area.

2. Provide any predictions presently possible of the effects of drilling (exploration and development) on the environment in this area.

3. Identify subject areas in which additional information is required for reasonable prediction and understanding of the environmental effects of drilling in this area.

4. Formulate recommendations for baseline studies and monitoring which will help to determine the environmental effects of oil and gas exploration and development in the South Atlantic Outer Continental Shelf area.

FINAL REPORT:

Conference/Workshop Proceedings Bureau of Land Management's Environmental Studies Program for the South Atlantic OCS Area (M. F. Massoglia, Compiler, 1976)

AVAILABILITY:

Available from NTIS: Final Report - PB80195043

SUMMARY:

The Research Triangle Institute conducted a conference/workshop to determine the nature and extent of the environmental studies required to measure and monitor the effects of exploration and development on the marine environment. Participants consisted of knowledgeable and interested members of the scientific community, State and Federal Agencies, industry, and the public sector. Discussions and specific recommendations are included in the final report. The following were considered to be of major importance:

1) The possibility of accidents resulting from geologic hazards.
2) Permanent destruction of unique environments.
3) The effects of metals and hydrocarbons on organisms and the possible return of these elemental compounds to man.

SOUTH ATLANTIC

Environmental Inventories and Assessments

CONTRACT NO. EQ4AC007

TITLE: A Socioeconomic Environmental Baseline Summary for the South Atlantic Region between Cape Hatteras, North Carolina, and Cape Canaveral, Florida

DATE: September 1974

PRIME CONTRACTOR:
Virginia Institute of Marine Science (VIMS)
Gloucester Point, Virginia 23062

PROGRAM MANAGER:
Maurice P. Lynch

FINAL REPORT:
A Socioeconomic Environmental Baseline Summary for the South Atlantic Region between Cape Hatteras, North Carolina, and Cape Canaveral, Florida (Vol. I - J. P. Jacobson; Vol. II - E. P. Ruzecki; Vol. III - M. H. Roberts et al.; Vol. IV - J. M. Ziegler et al.; Vol. V - VIMS; 1974)

AVAILABILITY: Available from NTIS:

Final Report (Vol. I, Physical Oceanography)	-PB80216187
Final Report (Vol. II, Climatology)	-PB80216286
Final Report (Vol. III, Marine Chemistry & Biology)	-PB80216278
Final Report (Vol. IV, Marine Geology)	-PB81110371
Final Report (Vol. V, Socioeconomics)	-PB81127680

SUMMARY:

The geographic area covered in this report extends from Cape Hatteras, North Carolina, in the north, to Cape Canaveral, Florida in the south. Included within this area are portions of the coastal areas of South Carolina and Georgia. All or portions of 30 coastal counties are included within the study area.

Estuaries in this area tend to be partially mixed due to relatively low runoff per mile of coast. The proximity of the Gulf Stream to the continental shelf and the low runoff combine to cause the salinity of the coastal water to be somewhat higher than that of the coastal water north of Cape Hatteras. Surface isotherms parallel the coast and temperatures generally increase seaward. Maximum horizontal gradients and minimum vertical gradients of temperature are usually found during winter.

This coastal region is warm temperate in character with a strong maritime influence. There is a tendency toward an annual division into two seasons, with higher precipitation during the summer than the winter. Local afternoon thundershowers produce most of the summer rainfall. Wind activity is generally low, flowing mainly from the northern quadrants in winter and southern quadrants during summer. Severe storm development is infrequent throughout the region.

Geologically the area comprises the southern segment of the Atlantic Coastal Plain. The area between Cape Hatteras and Cape Romain is distinctive for its three large smooth scallops between Capes Hatteras, Lookout, Fear, and Romain. South of Cape Romain, the area is characterized by extensive salt marshes bordered by a belt of low lying islands, the "Sea Islands" of South Carolina and Georgia. South of the Sea Islands are extensive beaches and associated dunes which create lagoonal flats inland.

From a chemical standpoint, the area is characterized by generally low nutrient input from rivers, especially nitrogen, resulting in low phytoplankton production. Heavy detritus loads from adjacent salt marshes keep the oxygen level in estuaries below saturation. These streams have little capacity to assimilate additional oxygen demand.

Zoogeographically, the area comprises the Carolinian Province. At the northern end, long, narrow barrier islands, well separated from the mainland, are backed by irregularly flooded marshes. The enclosed sounds with muddy bottoms and high turbidity, are productive nursery grounds for commercial fish and shellfish. Along South Carolina and Georgia, the salt marshes provide the base of the food chain for the estuaries. Along the remainder of the coast, the mainland is exposed to the sea. The offshore region is sandy throughout with outcroppings of coral, rock, and other substrates called live-bottom habitats which are productive of fishery products. The biota is basically temperate with a number of subtropical species.

Economically, the area of the study is generally depressed. The highest degree of urbanization has occurred at the major ports in the area: Wilmington, North Carolina; Charleston, South Carolina; Savannah, Georgia; and Jacksonville, Florida. Per capita income in the area is below the U.S. averages in 29 of the 30 counties. Six counties are primarily dependent upon manufacturing as a source of income, six on farming, nine on government (primarily military bases), three on services, and six have no dominant sector.

This area then, beginning just below the southern limit of the North Eastern Megalopolis and extending to the booming Florida peninsula, is one of the largest portions of relatively unspoiled, undeveloped sea coast in the contiguous United States. The possibility of rapid coastal development should be of prime concern to planners and managers at all levels of government and industry.

BLM CONTRACT NO. AA550-CT7-39

TITLE: Summary and Analysis of Environmental Information on the Continental Shelf and Blake Plateau from Cape Hatteras to Cape Canaveral

DATE: 25 August 1977 - 1981

COST: $199,946

PRIME CONTRACTOR:

Center for Natural Areas (CNA)
P.O. Box 98
South Gardiner, Maine 04359

SUBCONTRACTORS/COOPERATING INSTITUTIONS:

Chesapeake Biological Laboratory (CBL)
The Citadel (Cit)
John Hopkins University (JHU)
Old Dominion University (ODU)
Skidaway Institute of Oceanography (SIO)
University of Florida (UF)
University of Georgia (UG)
University of Rhode Island (URI)
University of South Carolina (USC)
Virginia Institute of Marine Science (VIMS)

PROGRAM MANAGER:

William C. Reed
Patricia E. Ryan (Coordinator)

PRINCIPAL PARTICIPANTS:

Paul R. Adamus (CNA)
Raymond Alden (ODU)
Larry Atkinson (SIO)
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Donald F. Boesch (VIMS)
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F. John Vernberg (USC)
Herbert Windom (SIO)
Howard E. Winn (URI)

CONTRACTING OFFICER:

Paul Lubetkin

COR: Richard Defenbaugh

OBJECTIVES:
A complete survey (i.e., extending before 1974) was made of research conducted on the toxicity and microbiology in this geographical region. Special effort was taken to complement, but not duplicate except where noted, the literature survey conducted by the Virginia Institute of Marine Science (VIMS) (1974) on the continental shelf from Cape Hatteras to Cape Canaveral. Objectives are to:

1. Update the environmental survey by VIMS (1974) and provide analysis of all existing biological, chemical, and geological data.

2. Identify and summarize ongoing biological, chemical, and geological programs in the South Atlantic region.

3. Identify sources of raw data and unworked samples, and evaluate the role of this material in relation to the total existing data base.

4. Identify gaps in the biological, chemical, and geological data base and evaluate the extent of these gaps.

FINAL REPORT:
A Summary and Analysis of Environmental Information on the Continental Shelf and Blake Plateau from Cape Hatteras to Cape Canaveral (CNA, 1979)

AVAILABILITY: Available from NTIS:

Final Report (Vol. I, Bk. 1, Introduction, Geology, Chemistry, Phytoplankton, Zooplankton, Neuston, Neston) - PB80184096

Final Report (Vol. I, Bk. 2, Benthos, Commercial Fisheries, Sport Fisheries, Marine Benthic Flora, Marine Mammals, Marine Birds) - PB80184104

Final Report (Vol. I, Bk. 3, Marine Turtles, Endangered Species, Microbiology, OCS Uses) - PB80184112

Final Report (Vol. I, Bk. 4, Endangered Environments, Toxicity and Health Studies, Summary and Synthesis) - PB80184120

Final Report (Vol. II, Master Bibliography, Index, Acknowledgements) - PB80201700

Appendices (Vol. III) - PB80208945

SUMMARY:

The geographical area covered extends from Cape Hatteras, North Carolina, to Cape Canaveral, Florida, from the spring tide mark to the 1,500 m isobath, encompassing four coastal states--North Carolina, South Carolina, Georgia, and Florida. Major topics inventoried and presented are Marine Geology, Chemistry, Phytoplankton, Zooplankton, Neuston, Nekton, Benthos, Commercial Fisheries, Sport Fisheries, Marine Benthic Flora, Marine Mammals, Marine Birds, Marine Turtles, Endangered or Threatened Species, Microbiology, Outer Continental Shelf (OCS) Uses, Unique or Endangered Environments, and Toxicity and Health Studies. The following data gaps were identified:

Geology
  -Shallow-and deep-core drilling for seismic correlation.
  -Detailed mapping of sediments and topography of the sea floor.
  -Occurrence, value, and accessibility of mineral deposits and environmental implications of mining them.
Chemistry
  -Hydrocarbons and trace metals in inshore particulates, sediments, and biota.
  -Hydrocarbons and trace metals in the offshore water column, sediments, and biota.
Phytoplankton
  -Seasonal productivity patterns of the inner and outer shelf.
  -Influence of various pollutants on locally occurring species.
Zooplankton
  -Small and large-scale patterns of distribution and abundance in relation to the environmental factors which control them.
Neuston
  -Survey of the areal and seasonal incidence of neustonic constituents.
  -Relationships of neustonic species and hydrocarbons of various chemical types and physical states.
Marine Benthic Flora
  -Distribution of algal species on offshore hard bottoms.
  -Factors which control the distribution of marine benthic algal species in the area.
Microbiology
  -Dynamics of the microbial organisms of estuaries in relation to total ecosystem metabolism, and especially the higher trophic levels.
  -Total spectrum petroleum-decomposing abilities of microorganisms characteristic of each coastal, shelf, and slope habitat.
Benthos
  -Distribution and dynamics of macrobenthos of the shelf, with special reference to the hard bottoms.
  -Functional roles of the benthos in the overall metabolism of estuarine and shelf systems needs further study and quantification.
Nekton
  -Species studies within the context of the broader ecosytems of which they are integral parts.
Turtles
  -Breeding activities (by site and season) and methods of reducing nest and hatchling mortality.
  -Natural history and population phenomena of hatchlings during the critical first year of life.
  -Migration and population phenomena of older turtles which utilize the area.

Birds

- Seasonal distribution patterns for pelagic seabirds.
- Feeding ecology for pelagic and nearshore species.
- Effects of oil platforms on migration and food supplies.

Mammals

- Information on local movements and migrations.
- More complete information on population size of resident and migrant populations and species.

Commercial Fisheries

- Physical and biological factors affecting recruitment and survival.
- Relations of the sports fishery to the commercial fishery for each species, and relations of the species within the ecosystems.

Threatened and Endangered Species

- Further studies are needed to establish the status of many species currently listed as "status uncertain".
- The factors which lead to the decline of each species should be investigated on a case-by-case basis to provide insights for more effective species protection strategies.

Unique or Endangered Environments

- Virtually nothing is known of the distribution of critical habitats on submerged lands of the shelf, and the only protected sites are a civil warship and a number of artificial fishing reefs. Survey and site designation here is a critical gap.

Toxicity and Health Studies

- Information concerning biological effects of sublethal and chronic exposure to individual toxicants.
- Information concerning combined effects of multiple exposures to these substances.

BLM CONTRACT NO. AA851-CT1-68/MMS CONTRACT NO. 14-12-0001-29189

TITLE: North Carolina Fisheries and Environmental Data Search and Synthesis Study.

DATE: 30 September 1981 - September 1983

COST: $169,730

PRIME CONTRACTOR:
Continental Shelf Associates, Inc. (CSA)
P.O. Box 3609
Tequesta, Florida 33458

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Florida Atlantic University (FAU)
Harbor Branch Foundation (HBF)

PROGRAM MANAGER:
David A. Gettleson

PRINCIPAL PARTICIPANTS:
Dennis J. Adamek (CSA)
Brian J. Balcom (CSA)
Neal S. Coulter (FAU)
Richard Hammer (CSA)
Roy Levow (FAU)
Kristen L. Metzger (HBF)
Russell E. Putt (CSA)
John Thompson (CSA)

CONTRACTING OFFICER:
Frances L. Sullivan
Jeffrey P. Petrino

COR: William H. Lang

OBJECTIVES:

1. Collect and annotate information on living resources and habitats of the North Carolina Outer Continental Shelf (OCS) to 200 meters.

2. Produce a computer program to file and sort annotated references based on key words, authors, and geographic location. Include with this program the complete North Carolina (NC) data base, operators manual, and key word thesaurus.

3. Write a final report to update and expand on previous BLM (now MMS) literature reviews (EQ4AC007, CT7-16, CT7-39) for the specified NC study area.

FINAL REPORT:

North Carolina Fisheries and Environmental Data Search and Synthesis Study (CSA, 1983)

AVAILABILITY:

Available from NTIS:
Executive Summary -PB84141357
Final Report -PB84141365

SUMMARY:

Available information on the living marine resources and habitats of the North Carolina OCS, from shore to a depth of 200 m (656 ft) was collected, annotated, and synthesized. Over 1,450 published and unpublished data sources were reviewed. Written sythesis chapters summarized the geology, oceanography, biological communities, commercial and sport fisheries, endangered and threatened species, and sensitive biological areas and unique habitats. Data gaps were identified, implications to OCS development were discussed, and suggestions for additional research were provided. In addition, a computer program was designed to catalog and sort all of the pertinent annotated information sources. The purpose of this computer program was to provide the Minerals Management Service (MMS) with a useful and viable method of maintaining, updating, and expanding the data base.

The North Carolina OCS is a transition zone between the South and Middle Atlantic Bight. The climate, proximity, and behavior of the Gulf Stream, and the presence of cuspate projecting shoals and capes influence unique oceanographic and biological features. Extensive hard/live bottom areas are present within Onslow Bay and along the North Carolina Continental Shelf edge. Upwelling along the North Carolina Continental Shelf edge and the intrusion of nutrient rich eddies into middle- and inner-shelf waters occur frequently along this coast. The upwelling-eddy, formation-intrusion phenomenon is not well understood and its ecological implications are just beginning to be studied. The present lack of knowledge in this area makes risk assessment for OCS development activities difficult. Additional studies of the coupling of physical and biological processes along the North Carolina Continental Shelf are needed in order to formulate effective OCS management policies for that area.

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SOUTH ATLANTIC

Socio-Economic Studies

BLM CONTRACT NO. AA551-CT8-40

TITLE: Summary and Analysis of Cultural Resources Information on the Continental Shelf from Cape Hatteras, North Carolina, to Key West, Florida.

DATE: 18 September 1978 - December 1981

COST:
$186,453
$ 6,682
$ 28,582
$221,717

PRIME CONTRACTOR:
Science Applications, Inc. (SAI)
1764 Old Meadow Lane, Suite 400
McLean, Virginia 22102

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Thunderbird Research Corporation (TRC)
New Found Harbor Marine Institution (NFHMI)
University of South Florida (USF)

PROGRAM MANAGER:
Dennis T. Stanczuk

PRINCIPAL PARTICIPANTS:
Mary Ellen Aheam (USF)
John Baskin (USF)
Jay Custer (TRC)
William M. Gardner (TRC)
Stephen Gluckman (USF)
Roderick G. Hansen (SAI)
Gary Haines (TRC)
Albert C. Hine (USF)
Daniel Koshi-Karrel (USF)
John D. Milliman (WHOI)
Loreli Rappelye (TRC)
Timothy Thompson (TRC)
S. David Webb (USF)

CONTRACTING OFFICER:
Paul Lubetkin
Carroll D. Day

COR:
Richard Defenbaugh
Murray Brown
Mark Grussendorf

OBJECTIVES:

The program objectives were to:

1. Review the later Quartenary geology of the study area (fig. 12), Mean High Water (MHW) to the 200-m isobath, as it relates to the cultural resources.

2. Assess the total cultural resources that can be found (with specific emphasis on prehistoric archeology and historic shipping).

3. Determine the probability of resource occurrence by area and/or feature (including map depicting cultural resource zones).

4. Identify potential pilot study areas.

5. Review present study techniques and provide recommendations for modification of search and recovery techniques.

6. Delineate significant data deficiences.

7. (MOD. 2). Arrange a seminar on the prehistoric model.

FINAL REPORT:
A Cultural Resource Survey of the Continental Shelf from Cape Hatteras to Key West (SAI, 1981)

AVAILABILITY:
Available from NTIS:
Final Report (Vol. I, Introduction & Physical Environment) - PB82138215
Final Report (Vol. II, Prehistoric Archaeology) - PB82138223
Appendices (Vol. III) - PB82138231
Final Report (Vol. IV, Conclusions & Recommendations) - PB82138249

SUMMARY:

Sedimentary characteristics (composition, load, and mobility) and water movements were considered important in preserving, destroying, or moving various artifacts.

Paleo-rivers on the submerged shelf were likely locations for prehistoric human habitation during exposed periods (Pleistocene and Holocene). Rivers provided important lithic materials and sources of freshwater and attracted game animals. Several present-day coastal plain and piedmont rivers exist on the submerged shelf off North Carolina (i.e., White Oak and Cape Fear). The Santee River has been traced onto the shelf off South Carolina. The Georgia OCS was traversed by the Savannah and Altamaha Rivers. In northern Florida, the St. Johns and St. Marys Rivers extended on the shelf. Whether prehistoric man ever inhabited areas on the emergent shelf is not directly discernable, but predictions can be made using information concerning availability and location of required resources.

Cape Hatteras and southern Florida contain the highest densities of shipwrecks. The highest shipwreck concentrations occur along the shoals of Cape Hatteras, Cape Lookout, and Cape Fear. Over 500 shipwreck sites were documented for southern Florida. Most shipwrecks along the Georgia and South Carolina coasts occur inshore of the 20-m isobath. Expected impacts from OCS oil and gas activiites will vary according to type of operation and where it is focused. Three areas of concern include: (1) offshore waters where drilling and monobouy terminal contruction would occur; (2) inshore waters which will be traversed by pipelines; and (3) coastal waters where storage, pumping and support facilities would be built.

The synthesized data were used to develop management schemes which would protect, identify, and enhance cultural resources. The prehistoric archaeological model was based on distribution of environmental variables and how they might act to preserve, destroy, or concentrate artifacts. Management Zone I consisted of the 12,000-year shoreline along the South Carolina and Georgia coasts. Management Zone II encompassed the area within the 16,000-year shoreline. Shipwreck sensitivity zones were designated inshore of the 20-m isobath off North Carolina and Florida.

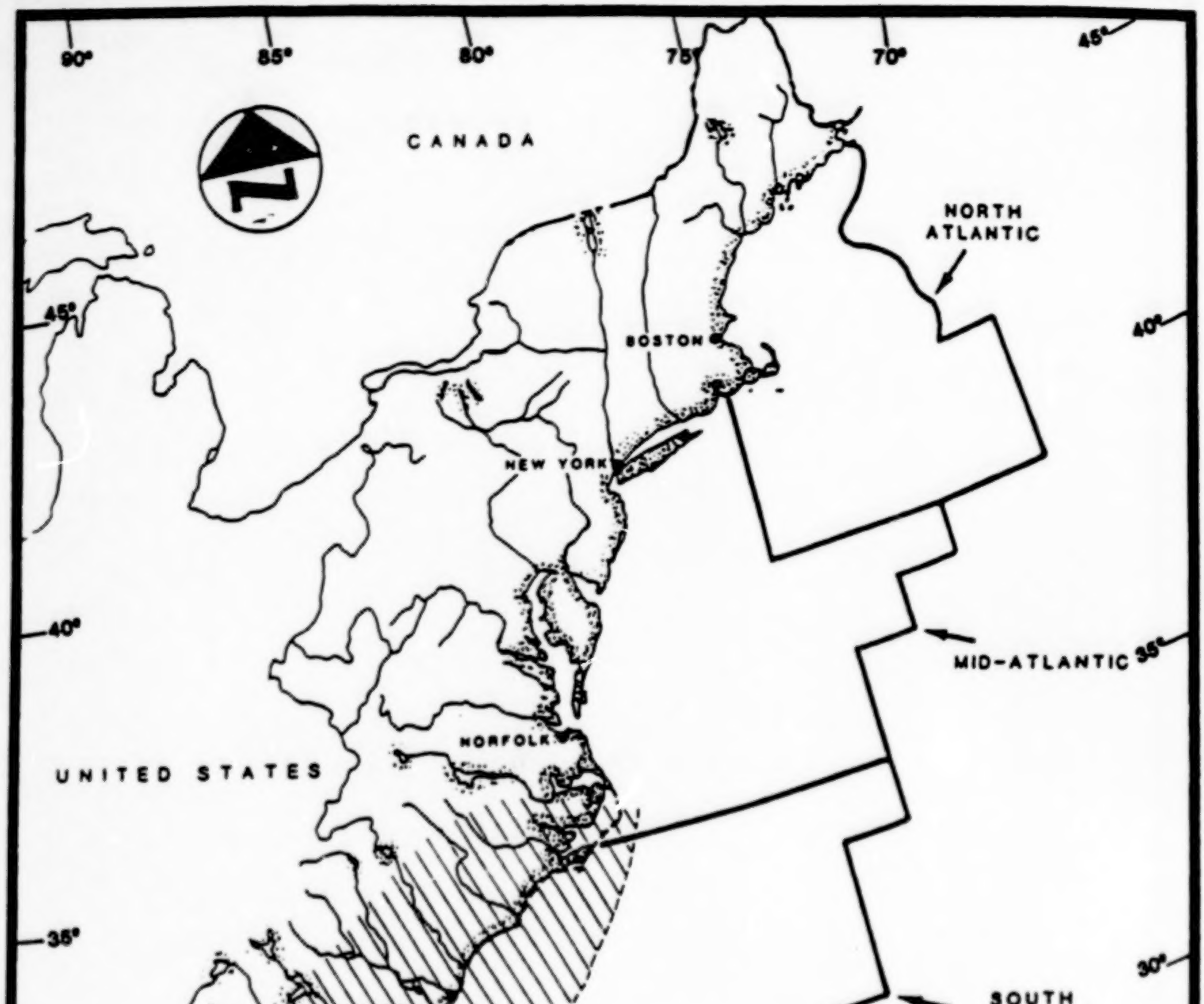

Figure 12. Study area for the "Summary and Analysis of Cultural Resources Information on the Continental Shelf from Cape Hatteras, North Carolina, to Key West, Florida", BLM Contract No. AA551-CT8-40.

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SOUTH ATLANTIC

Geology/Chemistry

BLM INTERAGENCY AGREEMENT NO. AA550-MU6-56

TITLE: South Atlantic OCS Geological Studies, FY '76

DATE: 30 September 1976 - August 1979

COST: $1,152,032

PRIME CONTRACTOR:

U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

OBJECTIVES:
The objectives of the U.S. Geological Survey's geologic environmental research program were to:

1. Measure the rate of sediment mobility over the seabed and monitor resultant changes in bottom morphology and texture.
2. Determine the concentration, distribution, and flux of suspended particulate matter in the water column.
3. Determine the vertical distribution of trace metals in the near surface sediment at selected locations.
4. Evaluate potential geologic hazards to oil and gas development due to surficial and intermediate depth structure and mass sediment transport events.
5. Identify and determine the significance of outcrop and reef structures.
6. Support the activities of the chemical/biological benchmark contractor by obtaining supportive sediment texture, composition, and physical oceanographic information.

FINAL REPORT:

South Atlantic Outer Continental Shelf Geological Studies, Fiscal Year 1976: Geology (USGS, 1979)

AVAILABILITY:

Final Report is available from Minerals Management Service
Vienna, Virginia 22180

SUMMARY:

These studies cover investigations of the water column down to the deeper stratigraphy. Each chapter deals with a different topic.

The suspended load varies seasonally; highest in the winter, slightly lower during the summer, and considerably lower during the spring and fall. Inshore suspended loads were higher than offsfore loads, probably reflecting input of sediment from the Savannah and Altamaha rivers and seasonal storms.

The study indicates that the shelf is not a sink for pollutants, as fine-grained particles are sparse on the shelf and that river-generated fines ultimately bypass the shelf to be deposited on the slope and rise.

Transmissometer profiles indicate that a surface or near-surface turbidity maximum is a persistent feature during the March, June, and August sampling periods. This feature is typically 5-15m thick and is related to higher concentrations of planktonic organisms.

The bottom currents on the middle part of the South Atlantic Shelf were typically 20 cm sec^{-1} and were dominated by the semidiurnal tide. Superimposed on the tidal currents were low frequency fluctuations of 5-10 cm sec^{-1} probably caused by Gulf Stream intrusions or wind stress and high frequency motions of 5-15 cm sec^{-1} probably associated with internal waves.

The distribution of surficial sediment parameters suggests the following general conclusions: although patchiness occurs, nearshore sediments tend to be fine-grained sand whereas central and outer shelf tend to be coarse grained. Slope sediments are also fine-grained.

OTHER PUBLICATIONS/REPORTS:

Blackwelder, B.W., O.H. Pilkey, and J.D. Howard. 1979. Late Wisconsinian sea level on southeast U.S. Atlantic shelf based on in-place shoreline indicators. Science 204:618-620.

Bothner, M.H., P.J. Aruscavage, W.M. Ferrebee, and P.A. Baedecker. 1980. Trace metal concentrations in sediment cores from the Continental Shelf off the southeastern United States. Journal of Estuarine and Coastal Marine Science 10:523-541.

Edsall, D.W. 1979. Southeast Georgia Embayment high-resolution seismic reflection survey: U.S. Geological Survey Open-File Report 78-800, 90 p.

Edsall, D.W., and W.P. Dillon. 1977. Geological development of Cenozoic continental margin of Southeast Georgia Embayment (abs.). American Association of Petroleum Geologists, Abstracts, p. 92.

Paull, C.K. and W.P. Dillon. 1979. The formation of the Florida-Hatteras slope (abs.): Geological Society of America, Abstracts with Programs, v. 11, no. 4, p. 207.

Paull, C.K. and W.P. Dillon. 1980. Structure, stratigraphy, and geologic history of the Florida-Hatteras shelf and inner Blake Plateau: American Association of Petrolaum Geologists Bulletin 64:339-358.

Popence, P. 1978. Geologic hazards of offshore oil exploration: Offshore Oil Structures Seminar Program, Colegio de Ingenieros Arquitectos y Agrimensores, San Juan, Puerto Rico, January 19-20, 1978.

Sylwester, R.E. and W.P. Dillon. 1977. Active growth fault on seaward edge of Blake Plateau. Geological Society of America, Abstracts with Programs, v. 9, no. 7, p. 1195.

U.S. Geological Survey. 1979. South Atlantic Outer Continental Shelf geological studies, fiscal year 1976, geology, ed. by P. Popence. U.S. Department of Commerce National Technical Information Service Report PB300-820, 562 p.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

MU0-16/29175
MU0-18/29175
IA1-15/29183
IA1-17/29184
IA2-26/29196
CT5-42 & MU5-33
CT6-62 & MU7-31
MU6-29
MU8-21
MU8-24
MU9-04
MU9-08/29166

BLM INTERAGENCY AGREEMENT NO. AA551-MU8-13

TITLE: Geological Oceanography of the South Atlantic OCS Region (Year 2)

DATE: 8 February 1978 - 17 July 1981

COST: $984,598

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Duke University (DU)
University of Georgia (UG)
University of South Florida (USF)
Woods Hole Oceanographic Institution (WHOI)

PROGRAM MANAGER:
Peter Popenoe

PRINCIPAL PARTICIPANTS:
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Mahlon M. Ball (USGS)
Peter R. Betzer (USF)
Mike Bothner (USGS)
Bradford Butman (USGS)
Zack Clayton (USF)
Elizabeth L. Coward (USGS)
Larry J. Doyle (USF)
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R. T. Giles (UG)
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David S. Hosom (WHOI)
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Marshall L. Otter (USGS)
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Orrin Pilkey (DU)
Paul R. Pinet (USGS)
Paul Schroeder (USF)
W. Strahle (USGS)
Frederick M. Wall (USF)

CONTRACTING OFFICER:
Paul Lubetkin

COR: Edward D. Wood
Murray Brown

OBJECTIVES: The objectives of this study are to:

1. Determine the sedimentation rate and processes on the upper slope and inner Blake Plateau (piston cores).

2. Determine the distribution, areal extent, and vertical characteristics of geological features supportive of biological communities.

3. Monitor the transport of bottom sediments across the outer continental shelf (OCS); evaluate its possible effect on pollutant transfer along the seabed and the potential of sediment as a pollutant sink; determine the implications of erosion/deposition on pipeline emplacement; and aid the interpretation of chemical, biological, and physical data (includes construction of third tripod and deployment - recovery and data reduction covered on FY '79 Memorandum of Understanding).

4. Complete analysis of benchmark seston samples (effort modified).

5. Study the shelf edge and slope near areas of oil and gas interests and the northern portion of the Blake Plateau for evidence of geological instability.

FINAL REPORT:

A Summary of Environmental Geologic Studies on the Southeastern United States Atlantic Outer Continental Shelf 1977-1978. U.S. Geological; Survey Open-File Report 81-583, 45 p. (P. Popenoe, 1981)

Environmental Geologic Studies on the Southeastern Atlantic Outer Continental Shelf, 1977-1978. United States Geological Survey Open-File Report 81-582-A, 81-582B, appendices, 691 p. 15 plates (P. Popenoe, editor, 1981)

AVAILABILITY: Available from NTIS:
Executive Summary - PB82109273
Final Report - PB82109265

SUMMARY:

This report is a summary of the second year of marine environmental research activities by the U.S. Geological Survey (USGS) on the southeastern U.S. Atlantic Continental margin, in accordance with Memorandum of Understanding (MOU) AA551-MU8-13 between the USGS and the Minerals Management Service (MMS) (formerly Bureau of Land Management).

The report covers studies whose fieldwork was conducted during the period from 1 October 1977 to 30 September 1978.

Chapter 2 discusses chemical variations in particulate matter within the water column, Chapters 3 to 5 discuss results of sampling of bottom sediments, Chapter 6 discusses the reefs and hard ground of the Georgia Bight, and Chapters 7 and 8 the stratigraphy and geologic hazards as defined by seismic-reflection surveys.

Eight large maps showing the distribution of reefs, hard grounds, benthic organisms, and bed forms, six plates showing line drawings of seismic stratigraphy, and one large map defining the distribution of geologic hazards to petroleum exploration and development are included in a pocket in the rear of this volume. Also included on microfiche film are appendices for chapters 2, 3, 4, and 5.

OTHER PUBLICATIONS/REPORTS:

Ayers, M.W., L.J. Doyle, and O.H. Pilkey. 1982. Depositional processes of the Florida-Hatteras slope and inner Blake Plateau (abs). American Association of Petroleum Geologists, Atlantic Margin Energy Conference, Oct. 4-6, 1981.

Behrendt, J.C., R.M. Hamilton, H.D. Ackermann, V.J. Henry, and K.C. Bayer. 1980. Seismic reflection evidence for Cenozoic reactivation of older faults on land and offshore in the area of the Charleston, South Carolina, 1886 earthquake. Geological Society of America, Abstracts with Programs, v. 12, no. 7, p. 384-385.

Bothner, M.H. and S.D. Locker. 1977. Pb-210 in Continental Shelf sediments off the eastern United States: An indicator of the depth of reworking (abs.). Geological Society of America, Abstracts with Programs, v. 9, no. 7, p. 906.

Butman, B., and M. Noble. 1978. Long-term in situ observations of bottom sediment movement on the U. S. Atlantic Continental Shelf: EOS, Transactions, American Geophysical Union 59(4):295.

Doyle, L.J. and O.H. Pilkey, eds. 1979. Geology of Continental Slopes. Society of Economic Paleontologists and Mineralogists Special Publication 27, 374p.

Doyle, L.J., O.H. Pilkey, and C.C. Woo. 1979. Sedimentation on the eastern U.S. Continental Slope. In Geology of Continental Slopes, ed. by O.H. Pilkey and L.J. Doyle. Society of Economic Paleontologists and Mineralogists Special Publication 27, p. 119-129.

Foley, F.D., 1981. Neogene seismic stratigraphy and depositional history of the lower Georgia coast and Continental Shelf: Master's thesis, University of Georgia, under the supervision of V.J. Henry.

Foley, F.D., and V.J. Henry. 1981. Neogene seismic stratigraphy and depositional history of the lower Georgia coast and Continental Shelf. AAPG/SEPM Atlantic Margin Energy Conference, Atlantic City, October 4-6, 1981.

Folger, D.W., B. Butman, H.J. Knebel, and R. Sylwester. 1978. Environmental hazards on the Atlantic Outer Continental Shelf of the United States. Tenth Offshore Technology Conference, Houston, Texas, p. 2293-2306.

Manheim, F.T., P. Popenoe, W. Siapno, and C. Lane. 1982. Manganese-phosporite deposits of the Blake Plateau. In Marine mineral deposits, ed. by P. Halbach and P. Winter. Proceedings of the Clausthaler Workshop, Essen, West Germany, September 1982, Verlay Gluckauf Gmb H., p. 9-44.

Paull, C.K., P. Popenoe, W.P. Dillon, and S.M. McCarthy. 1980. Geologic subcrop map of the Florida-Hatteras shelf, slope, and inner Blake Plateau. U.S. Geological Survey Miscellaneous Field Investigations Map MF-1171, scale 1:500,000.

Pilkey, O.H., B.W. Blackwelder, J.D. Howard, and H.J. Knebel. 1979. History of the Georgia Emabayment sediment cover (abs.). Geological Society of America, Abstracts with Programs, v. 11, no. 4, p. 209.

Pilkey, O.H., B.W. Blackwelder, H.J. Knebel, and M.W. Ayers. 1981. The Georgia Embayment Shelf: Stratigraphy of a submergence: Geological Society of America Bulletin, v. 92, p. 52-63.

Pinet, P.R., and P. Popenoe. 1980. Cenozoic flow patterns of the Gulf Stream over the Blake Plateau (abs.). Geological Society of America, Abstracts with Programs, v. 12, no. 7, p. 500.

Pinet, P.R., P. Popenoe, and D.F. Nelligan. 1981. Gulf Stream: Reconstructions of Cenozoic flow patterns over the Blake Plateau. Geology 9(6):266-270.

Pinet, P.R., and P. Popenoe. 1981. Effects of large scale shifts of the Gulf Stream on Miocene sedimentation patterns. American Association of Petroleum Geologists Atlantic Margin Energy Conference, October 4-6, 1981.

Pinet, P.R. and P. Popenoe. 1981. Shallow seismic stratigraphy and post-Albian geologic history of the northern and central Blake Plateau (abs.). Geological Society of America, Abstracts with Programs, v. 13, no. 7, p. 529.

Pinet, P.R., and P. Popenoe. 1982. Late Cretaceous depositional patterns on the Blake Plateau (abs.). Geological Society of America, Abstracts with Programs, v. 14, nos. 1 and 2, p. 73.

Pinet, P.R., and P. Popenoe. 1982. Blake Plateau; control of Miocene sedimentation patterns by large-scale shifts of the Gulf Stream axis. Geology 10:257-259.

Pinet, P.R., and P. Popenoe. 1985. Shallow seismic stratigraphy and post-Albian geologic history of the northern and central Blake Plateau. Geological Society of America Bulletin, v. 96, no. 5, p. 627-638.

Pinet, P.R., P. Popenoe, and S. Beach. 1984. Paleoenvironmental significance of Turonian-Coneacian seismic facies of the northern Blake Plateau. Geological Society of America Abstracts with Programs, v. 16, no. 6, p. 624.

Pinet, P.R. and P. Popenoe. 1985. A scenario of Mesozoic-Cenozoic ocean circulation over the Blake Plateau and its environs. Geological Society of America Bulletin, v. 96, no. 5, p. 618-626.

Popenoe, P. 1979. Geological hazards and constraints to petroleum exploration and developement on the southeastern United States Continental Shelf, Slope, and Blake Plateau (abs.). Second Symposium on the Geology of the Southeastern Coastal Plain, March 5-6, 1979, Program and Abstracts, p. 19-20.

Popenoe, P. 1980. Single-channel seismic-reflection profiles collected on the northern Blake Plateau, 29 September to 19 October 1978. U.S. Geological Survey Open-File Report 80-1265, 4p.

Popenoe, P., B. Butman, C.K. Paull, M.M. Ball, and S. Pfirman. 1980. Interpretation of graphic data on potential geologic hazards on the southeastern United States Atlantic Continental Shelf. U.S. Geological Survey Miscellaneous Field Investigations MF-1276, 4 sheets.

Popenoe, P. and P.R. Pinet. 1980. The Upper Cretaceous clastic shelf edge off Georgia and South Carolina and the origin of the Charleston Bump (abs.). Geological Society of America, Abstracts with Programs, v. 12, no. 7, p. 501.

Woo, C.C., O.H. Pilkey, and L.J. Doyle. 1978. Authigenic heavy minerals of the Continental Slope sediments off the eastern United States (abs.). Geological Society of America, Abstracts with Programs, v. 10, no. 7, p. 519.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

MU0-16/29175
MU0-18/29175
IA1-15/29183
IA1-17/29184
IA2-26/29196
CT5-42 & MU5-33
CT6-62 & MU7-31
MU6-29
MU6-56
MU8-21
MU8-24
MU9-04
MU9-08/29166

BLM INTERAGENCY AGREEMENT NO. AA551-MU9-8/
MMS INTERAGENCY AGREEMENT NO. 14-12-0001-29166

TITLE: Marine Habitat Mapping and Pipeline Hazard Assessment of the South Atlantic OCS

DATE: 15 January 1979 - January 1982

COST: $453,521

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Woods Hole Oceanographic Institution (WHOI)
University of Georgia (UG)
University of South Florida (USF)
Duke University (DU)
Lamont-Doherty Geological Observatory (LD)

PROGRAM MANAGER:
Peter Popenoe

PRINCIPAL PARTICIPANTS:
Bradford Butman (USGS)
Paul Bowker (USGS)
Dale Chayes (LD)
Elizabeth Coward (USGS)
C. J. McCreey (UG)
Larry Doyle (USF)
F. D. Foley (UG)
R. T. Giles (UG)
Vernon J. Henry (UG)
D. R. Kendall (UG)
Frank T. Manheim
T. H. McKissack (UG)
Marshall Otter (USGS)
Orrin Pilkey (DU)
William B. F. Ryan (LD)

CONTRACTING OFFICER:
Paul Lubetkin;
Carroll D. Day

COR: Edward Wood
Murray Brown
Mark Grussendorf

OBJECTIVES:

1. Determine the distribution, areal extent, and vertical characteristics of geological features supportive of biological communities via sidescan sonar, seismic reflection/precision depth recorder, and towed underwater TV (Ocean Bottom Survey of the Georiga Bight).

2. Study the shelf near areas of oil and gas interest and possible pipeline corridors for evidence of geological instability (Pipeline Corridor and Regional Hazards Assessment-Sale No. 56).

3. Develop methodology by which barium in sediment samples can be determined faster and more economically than by the presently accepted neutron activiation analysis (Barium Determination in Sediment).

4. Obtain information on the cause and effect relationship of bottom currents and storm surges to sediment and seston mobility (Bottom Sediment Mobility).

FINAL REPORT:

Data from this contract have been interpreted and synthesized in the final report of Contract No. IA2-26.

Manheim, F.T. and P.C. Bowker, 1980. Analysis of barium in sediments: U.S. Geological Survey Open-File Report 80-665, 19 p.

OTHER PUBLICATIONS/REPORTS:

Bowker, P.C., and F.T. Manheim. 1979. Barium and strontium determination in sediments (abs.). National Conference on Spectrochemical Excitation and Analyses Program, Groton, Conn., August 27-28, 1979.

Bowker, P.C. and F.T. Manheim. 1982. Analysis of barium and strontium in sediments by dc plasma emission spectometry. Applied Spectroscopy 36(4):378-382.

Coward, E.L., P. Popenoe, and M.L. Otter. 1980. Miocene-Pliocene unconformity on the Blake Plateau (abs.). Geological Society of America, Abstracts with Programs 12(7):407.

Freeman-Lynde, R.P., P. Popenoe, and F.W. Meyer. 1982. Seismic stratigraphy of the western Straits of Florida (abs.). Geological Society of America, Abstracts with Programs, v. 14, nos. 1 and 2, p. 18.

Henry, V.J. and R.T. Giles. 1979. Distribution and occurrence of reefs and hardgrounds in the Georgia Bight (abs.). Geological Society of America, Abstracts with Programs, v. 11, no. 4, p. 182.

Idris, F.M. 1983. Shallow structure and stratigraphy of the U.S. South Atlantic Shelf between Savannah, Georgia and Cape Romain, South Carolina. University of Georgia Dissertation thesis under the direction of Dr. V.J. Henry.

Kellam, J.A. 1981. Neogene seismic stratigraphy and depostional history of the Tybee Trough area, Georgia/South Carolina. University of Georgia, Master's thesis under the supervision of V.J. Henry.

Manheim, F.T. and P.C. Bowker. 1980. Analysis of barium in sediments: U.S. Geological Survey Open-File Report 80-665, 19 p.

Pinet, P.R. and P. Popenoe. 1982. Surface circulation in the western North Atlantic Ocean during Mesozoic and Cenozoic time (abs.). Geological Society of America, Abstracts with Programs, v. 14, no. 7, p. 588-589.

Popenoe, P. 1982. The middle Tertiary origin of Albemarle Sound, North Carolina (abs.). Geological Society of America, Abstracts with Programs, v. 14, nos. 1 and 2, p. 591.

Popenoe, P. 1983. High resolution seismic reflection profiles collected August 4-28, 1979, between Cape Hatteras and Cape Fear, North Carolina, and off Georgia and northern Florida. U.S. Geological Survey Open-File Report 83-512, 4 p.

Popenoe, P. 1985. Depositional and structural history of the Southeast Georgia Embayment and Suwannee Straits from seismic stratigraphic analyses: Geological Society of America, Abstracts with Programs, v. 17, no. 2, p. 129.

Popenoe, P. 1985. Seismic stratigraphy of sinkholes and the Boulder Zone under the northeastern Florida Continental Shelf: Geological Society of America, Abstracts with Programs, v. 17, no. 2, p. 129.

Popenoe, P., E.L. Coward, M.E. Vazzana, M.M. Ball, and D.W. Edsall. 1979. A high-resolution seismic survey of the Florida-Hatteras shelf and slope, and the Blake Plateau and Escarpment (abs.). Geological Society of America, Abstracts with Programs, v. 11 no. 4, p. 209.

Popenoe, P., K.D. Klitgord, W.P. Dillon, P.R. Pinet, and J.A. Grow. 1982. Structure and history of the Carolina Platform (Cape Fear Arch) (abs.). Geological Society of America, Abstracts with Programs, v. 14, nos. 1 and 2, p. 74.

Popenoe, P., F.A. Kohout, and F.T. Manheim. 1984. Buried sinkholes and karst in the Florida offshore from seismic reflection studies. Proceedings of the first multidisciplinary conference on sink holes, Orlando, Florida.

Popenoe, P., F.A. Kohout, and F.T. Manheim. 1984. Seismic reflection studies of sinkholes and limestone dissolution features on the northeastern Florida shelf. In Sinkholes, their Geology, Balkema, Rotterdam, Boston, p. 43-57.

Slater, R.A., D.W. Folger, B. Butman, M.H. Bothner, H.J. Knebel, J.A. Aaron, J.M. Robb, and P. Popenoe. 1979. Potential geologic hazards associated with the United States Atlantic continental margin. Offshore geologic hazard short-course notes. Rice University, Houston, Texas, p. 4-1 to 4-48.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

MU0-16/29175
MU0-18/29175
IA1-15/29183
IA1-17/29184
IA2-26/29196
CT5-42 & MU5-33
CT6-62 & MU7-31
MU6-29
MU6-56
MU8-13
MU8-21
MU8-24
MU9-04
MU9-08/29166

BLM INTERAGENCY AGREEMENT NO. AA851-MU0-16/
MMS INTERAGENCY AGREEMENT NO. 14-12-0001-29175

TITLE: South Atlantic OCS/Blake Plateau Hazards Mapping Study (South Atlantic Geological Program, Year 4)

DATE: 24 June 1980 - January 1982

COST:
$596,020
$159,000
$755,020

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
University of Georiga (UG)
Colgate University (CU)
Duke University (DU)
University of South Florida (USF)

PROGRAM MANAGER:
Peter Popenoe

PRINCIPAL PARTICIPANTS:
Kathy V. Cashman
Elizabeth L. Coward
L. J. Doyle (USF)
Vernon J. Henry, Jr. (UG)
T. H. McKissack (UG)
O. H. Pilkey (DU)
Paul Pinet
Edith Williams

CONTRACTING OFFICER:
Mr. Carroll Day

COR:
Mark Grussendorf
Murray Brown
Eiji Imamura

OBJECTIVES:

1. Conduct a stratigraphic study to determine the overall subbottom structure of the sedimentary sequence on the shelf, slope, Blake Plateau and Escarpment offshore of North Carolina.

2. Conduct a geohazards evaluation to identify those structures or features which could pose a hazard to oil and gas operations on the South Atlantic Outer Continental Shelf (OCS).

3. Conduct a sensitive biological communities study to determine the distribution, areal extent, and vertical characteristics of geological features supportive of biological communities on the Florida-Hatteras Shelf off North Carolina.

4. Continue efforts to compile and synthesize data for the Geological Atlas series for "Jacksonville" and "Brunswick" areas.

FINAL REPORT:

Data from this contract have been interpreted and synthesized in the final report of Contract No. IA2-26.

OTHER PUBLICATIONS/REPORTS:

Barnes, C.A., and V.J. Henry. 1983. A brief description of the shelf edge groundfish habitat, U.S. South Atlantic: submitted to Northeast Gulf Science.

Cashman, K.V. and P. Popenoe. 1985. Salt tectonic induced slumping on the Continental slope and rise off North Carolina. Manuscript submitted to Marine and Petroleum Geology 1/8/85.

Cashman, K.V., P. Popenoe, and D. Chayes. 1981. Sidescan sonar depiction of slump features associated with diapirism on the Continental Slope off the southeastern United States (abs.). American Association of Petroleum Geologists Bulletin 65(5):909.

Cashman, K.V., P. Popenoe, and J.A. Grow. 1980. Salt diapirs and related features on the southeastern U.S. continental margin as viewed by long-range sidescan sonar (abs.). Geological Society of America, Abstracts with Programs, v. 12, no. 7, p. 400.

Grow, J.A., W.P. Dillon, and P. Popenoe. 1979. Diapirs along the Continental Slope southeast of Cape Hatteras (abs.). Geological Society of America, Abstracts with Programs, v. 11, no. 4, p. 181.

Henry, V.J. and F.D. Foley. 1981. Bottom morphology and shallow subbottom sedimentary structures on the U.S. Continental Shelf between Cape Hatteras, North Carolina, and Jacksonville, Florida. AAPG/SEPM Atlantic Margin Energy Conference, Atlantic City October 4-6, 1981.

Paull, C.K. and W.P. Dillon. 1980. The appearance and distribution of the gas hydrate reflection off the southeastern United States. U.S. Geological Survey Open-File Report 80-88, 8 p.

Paull, C.K. and W.P. Dillon. 1981. The appearance and distribution of the gas hydrate reflection off the southeastern United States. U.S. Geological Survey Miscellaneous Field Studies Map MF-1252.

Popenoe, P., K.V. Cashman, D. Chayes, and W.B.F. Ryan. 1981. Mid-range sidescan-sonar images covering parts of proposed tracts for OCS Lease Sale 56 and contiguous areas, Manteo, Cape Fear, and adjacent

quadrangles off North Carolina. U.S. Geological Survey Open-File Report 81-554, 6p.

Popenoe, P., K.V. Cashman, and E.L. Coward. 1981. Environmental considerations for OCS development, Lease Sale 78 call area. In Summary report on the regional geology, environmental considerations for developemnt, petroleum potential, and estimates of undiscovered recoverable oil and gas resources of the United States southeastern Atlantic continental margin in the area of Oil and Gas Lease Sale no. 78, ed. by W.P. Dillon. U.S. Geological Survey Open-File Report 81-749, p. 59-98.

Popenoe, P., W.P. Dillon, C.K. Paull, and J.M. Robb, 1982. Environmental considerations. In Summary of regional geology, petroleum potential, resource assessment and environmental considerations for Oil and Gas lease Sale Area 56, ed. by W.P. Dillon. U.S. Geological Survey Open-File Report 82-398, p. 35-54.

Popenoe, P. and F.W. Meyer. 1983. Description of high-resolution seismic reflection data collected from the shelf, slope, and upper Rise between Cape hatteras, North Carolina, and Norfolk, Virginia; and Vero Beach to Miami, Florida: U.S. Geological Survey Open-File Report 83-515, 4 p.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

IA2-26/29196
MU6-56
MU8-13

BLM INTERAGENCY AGREEMENT NO. AA851-IA1-15/MMS INTERAGENCY AGREEMENT NO. 14-12-0001-29183

TITLE: Hazards Mapping Study (South Atlantic Geological Program, Year 5)

DATE: 4 March 1981 - August 1983

COST: $324,464

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTORS/COOPERATING INSTITUTION:
University of Georgia (UG)
Duke University (DU)

PROGRAM MANAGER:
Peter Popenoe

PRINCIPAL PARTICIPANTS:
Kathy V. Cashman (GS)
Francisco Chavez (DU)
Vernon J. Henry, Jr. (UG)
Paul Pinet

CONTRACTING OFFICER:
Carroll D. Day
Jeffrey Petrino

COR: Murray Brown
Eiji Imamura

OBJECTIVES:
The study phases and their objectives were as follows:

1. North Carolina Offshore Surficial Geology-Benthos Coupling Study. Synthesize available data and reports on the benthic communities offshore of North Carolina, together with geological data on surficial sediments and topography, into a working document for use by Minerals Manangement Service (MMS) (effort discontinued).

2. Geohazards and Geophysical Data Management and Interpretation Study. Complete the reduction of existing seismic and side-scan data into hazards maps and reports.

3. Marine Geologic Atlas Series Study. Update and continue the synthesis of all data obtained from the ocean bottom surveys in FY 1977-'78-'79-'80 with all other available data for the "Brunswick" and "Jacksonville" areas.

FINAL REPORT:

Data from this contract have been interpreted and synthesized in the final report of Contract No. IA2-26.

OTHER PUBLICATIONS/REPORTS

Behrendt, J.C., R.M. Hamiton, H.D. Ackerman, and V.J. Henry, 1981. Cenozoic faulting in the vicinity of the Charleston, South Carolina, 1886 earthquake. Geology 9(3):117-122.

Dillon, W.P., P. Popenoe, J.A. Grow, K.D. Klitgord, B.A. Swift, C.K. Paull, and K.V. Cashman. 1982. Growth faulting and salt diapirism: Their relationship and control in the Carolina Trough, Eastern North America. American Association of Petroleum Geologists Memoir 34, p. 21-46.

Henry, V.J., L.J. Doyle, and P. Popenoe. 1982. Reefs and hardgrounds of the Georgia Bight: Research summary. In Reefs and hardgrounds workshop, summary of results. Duke University Marine Laboratory, September 23-24, 1981, p. 7-9.

Henry, V.J., J.A. Kellam, and F.D. Foley. 1982. Evidence for Quaternary sea level stillstands on the Georgia Bight Continental Shelf (abs.). Geological Society of America, Abstracts with Programs, v. 14, nos. 1 and 2, p. 24.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

MU0-16/29175
MU0-18/29175
IA1-17/29184
IA2-26/29196
CT5-42 & MU5-33
CT6-62 & MU7-31

MU6-29
MU6-56
MU8-13
MU8-21
MU8-24
MU9-04
MU9-08/29166

SOUTH ATLANTIC

Physical Oceanography

BLM INTERAGENCY AGREEMENT NO. AA551-IA6-03 and
BLM INTERAGENCY AGREEMENT NO. AA551-IA8-37

TITLE: South Atlantic OCS Data Buoy, FY '76-'81

DATE: January 1976 - 30 September 1981

COST:

FY '76-'78	$152,600
FY '79	$117,400
FY '80	$ 81,000
FY '81	$101,600
TOTAL	$452,600

PRIME CONTRACTOR:
National Oceanic and Atmospheric Administration (NOAA)
NOAA Data Buoy Office
NSTL Station, Mississippi 39529

PROGRAM MANAGER:
Kurt D. Zimmerman

CONTRACTING OFFICER:
Paul Lubetkin
Carroll D. Day

COR: E. Wood; Richard E. Defenbaugh

OBJECTIVES:
The program objectives are as follows:

1. Deploy, operate, and maintain a meteorological monitoring buoy network for the South Atlantic Outer Continental Shelf, consisting of three buoys operating in a fully automatic mode in the following locations:

   a. off Charleston, South Carolina (32° 31'N, 78° 40'W);
   b. off Jacksonville, Florida (30° 16'N, 80° 27'W); and
   c. off Savannah, Georgia (31° 40'N, 79° 40'W).

2. Acquire automatically, from the buoys, hourly data frames of the following parameters:

   a. wind direction and magnitude (5-meter level);
   b. air temperature (5-meter level);
   c. atmospheric pressure (surface);
   d. sea surface temperature (1-meter depth); and
   e. surface wave spectral coefficients.

FINAL REPORT:
None.
Monthly data reports are on file at the Minerals Management Service, Vienna, Virginia.

BLM CONTRACT NO. AA550-CT7-16

TITLE: South Atlantic OCS Physical Oceanographic Literature Synthesis, FY 1977

DATE: February 1977 - July 1979

COST: $177,648

PRIME CONTRACTOR:

Environmental Research and Technology, Inc. (ERT)
699 Virginia Road
Concord, Maine 01742

SUBCONTRACTORS/COOPERATING INSITITUTIONS:

Clemson University (CU)
North Carolina State University (NCS)
University of Miami (UM)
Virginia Institute of Marine Science (VIMS)
Duke University Marine Laboratory (DUML)
Nova University (NU)

PROGRAM MANAGER:

Paul H. Kirshen

PRINCIPAL PARTICIPANTS:

Richard Barber (DUML)
Harold Bernard
James Bowley
David Brooks (NCS)
Thomas Curtin (NCS)
Bill Edge (CU)
Thomas Lee (UM)
Joel Narod
Leonard Pietrafesa (NCS)
Robert Weisberg (NCS)
Christopher Welch (VIMS)
Jan Witte (NU)

CONTRACTING OFFICER:

Paul Lubetkin

COR: Elwyn D. Wood

OBJECTIVES:

1. Identify and assemble recent oceanographic and meteorological data not available from the National Oceanographic Data Center (NODC) or National Climatic Center (NCC) for the South Atlantic region.

2. Organize the data on tapes in formats that are compatible with NODC/NCC and transmit them to NODC/NCC.

3. Update a previously prepared National Science Foundation (NSF) bibliography for the region.

4. Use recent previously catalogued data to describe, display, analyze, and interpret oceanographic and meteorological phenomena in the region.

5. Make recommendations for future sampling and buoy sites and programs based on the preceding analyses and a review of raw data and unworked samples.

FINAL REPORT:

Summary and Analysis of Physical Oceanographic and Meteorological Information on the Continental Shelf and Blake Plateau from Cape Hatteras to Cape Canaveral (ERT, 1979)

AVAILABILITY:

Available from NTIS: Executive Summary (Vol. I) - PB80159072
Final Report (Vol. II) - PB80159080
Final Report (Vol. III) - PB80159098

SUMMARY:

This report represents the synthesis and analysis of the physical oceanographic and meteorological data on the continental shelf and Blake Plateau from Cape Hatteras to Cape Canaveral. Numerous information sources were searched to obtain an analysis of the climatology, wave data, hydrography, and the circulation of the continental shelf waters, all of which are crucial to platform construction, safety procedures, and management decisions. Seasonal variations of air temperature, wind speed and wind direction, cloud cover, cloud ceilings, visibility, precipitation, storms, weather fronts, solar radiation and precipitation run-off are discussed and summarized. Several programs are currently in progress to better define the physical oceanography and meteorology of the outer continental shelf (OCS) study area.

A survey of climatological data was performed. In general, the OCS area is controlled by cyclonic (large-scale low pressure storms) activity in the winter and anti-cyclonic (high pressure) activity in the summer. In the winter the maximum of wind speeds, cloud cover, large-scale precipitation (that is, precipitation covering a large area) and low ceilings and visibilities occurs. In the summer the minimum of wind speeds, low cloud ceilings and visibilities occurs and the precipitation pattern changes to small-scale convective (that is, showers or thunderstorms). The mean daily precipitation reaches a minimum in spring and autumn.

Studies of the circulation of continental shelf water have shown that from about mid-shelf to the near-shore waters, tide- and wind-generated currents tend to produce most of the current variations. The tides are more influential on trans-shelf motions. The winds are more influential along the shelf fluctuations. The wind events generate horizontal east-west meanders of the western edge of the Gulf Stream.

BLM INTERAGENCY AGREEMENT NO. AA551-IA8-39

TITLE: South Atlantic OCS Satellite Oceanography.

DATE: 29 August 1978 - 24 September 1980

COST: $150,000

PRIME CONTRACTOR:

National Aeronautics and Space Administration (NASA)
Wallops Flight Center
Wallops Island, Virginia 23337

SUBCONTRACTORS/COOPERATING INSTITUTIONS:

EG&G Washington Analytical Group (EGG)
Applied Science Associates, Inc. (ASA)

PROGRAM MANAGER:

Norden Huang

PRINCIPAL PARTICIPANTS:

Clifford D. Leitao (NASA)
C. L. Parsons (NASA)
C. G. Parra (EGG)
J. D. McMillan (EGG)
G. S. Hayne (ASA)

CONTRACTING OFFICER:

Paul Lubetkin
Carroll Day

COR: Ed Wood

OBJECTIVES:

The main program objectives are to develop methodology for the use and interpretation of radar satellite altimeter data to estimate:

1. geostrophic ocean current position and velocity;
2. significant wave height (SWH); and
3. surface wind speed.

These estimates were concentrated in the South Atlantic Bight in order to define Gulf Stream characteristics in that area more completely.

FINAL REPORT:

Final Report of GEOS-3 Radar Altimeter Study for the South Atlantic Bight (NASA Tech. Memorandum 73286, 43 pp. + appendices) (C. D. Leitao, N. E. Huang, C. L. Parsons, C. G. Parra, J. D. McMillan, G.S. Hayne; 1980)

AVAILABILITY:

Available from NTIS: Final Report - 80N 26023

SUMMARY:

The analysis of long-term altimeter data to obtain sea surface topographies led to the following conclusions. The mean surface topographic maps should be evaluated with extreme caution, due to the various uncertainties in geoid, orbit, and intrinsic noises. The accuracy of the geoid was the most critical element because the geoid anomalies may have the same wavelength as ocean dynamic phenomena, and the geoid signal magnitude can also be much higher. The difference between the long-term (three years) and short-term (one month) means revealed changes of Gulf Stream path, and some eddy movements. In principle, the uncertainty of the geiod should not have been a problem here, but it did cause difficulty because of the data density from the altimeter. The long-term mean was produced by using the average of all the adjusted heights within a 1/2 degree square, and there could have been considerable geoid change within such an area. The averaging process reduced the true variations.

It was apparent that seasonal and annual variations in significant wave height and wind speed were readily detectable using waveform data from satellite radar altimetry, and this was demonstrated with Geodetic Experimental Ocean Satellite (GEOS-3) measurements taken over the South Atlantic Bight during this study. Different degrees of spatial and temporal averaging were used to avoid undersampling. Some differences in the resultant wind speed distributions were found to agree with the known climatology of the area, on the smallest spatial scale tested. No wave height spatial difference was detected, as expected, given the low wave heights found in the South Atlantic Bight.

OTHER PUBLICATIONS/REPORTS:

Huang, N. E., 1979. On surface drift currents in the ocean. J. Fluid Mech. 91:191-208.

Huang, N. E. and C. D. Leitao, 1978. Large-scale Gulf Stream frontal study using GEOS-3 radar altimeter data. J. Geophys. Res. 83:4672-4682.

BLM CONTRACT NO. AA550-CT7-29

TITLE: South Atlantic Physical Oceanography Study (SAPOS), Year 1

DATE: 20 May 1977 - July 1979

COST: $1,318,729

PRIME CONTRACTOR:
Science Applications, Inc. (SAI)
4900 Waters Edge Drive, Suite 255
Raleigh, North Carolina 27606

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
North Carolina State University (NCS)
University of Miami (UM)

PROGRAM MANAGER:
Paul Debrule

PRINCIPAL PARTICIPANTS:
Otis Brown (UM)
Thomas Curtin (NCS)
Tom Lee (UM)
J. Fernandez-Partagas (UM)
Len Pietrafesce (NCS)
D. Tung (NCS)
Van Waddell (SAI)

CONTRACTING OFFICER:
J. A. Rourke
Paul Lubetkin
Carroll D. Day

COR: Ed Wood

OBJECTIVES:
The long range objectives of the physical oceanography study were to:

1. Predict the dispersal, dilution, flushing, and final distribution of hydrocarbons and other pollutants that may be introduced into the marine environment as a result of outer continental shelf (OCS) related oil and gas activities.

2. Provide information necessary to understand the biological and chemical systems in the Georgia Embayment and the effects of hydrocarbons and other pollutants on these systems.

It is expected that a period of three years, plus about one year for the production of a final report, will be required to achieve the program objectives [Modified to 5-year program under Contract CT8-52]. First year objectives were to:

1. Describe the surface movement across the turbid-clear water zone.

2. Determine the short term (days to several weeks), vertical current structure near the shelf edge.

3. Characterize the seasonal variations in shelf water masses and short term variations in shelf edge water mass.

4. Correlate Georgia Embayment meteorological and sea state data with coastal meteorological data, National Weather Service (NWS) predictions, and with satellite photographs (e.g., LANDSAT - Band 5 photographs).

5. Investigate the effect of Gulf Stream intrusions on shelf water masses.

6. Determine the long-term (one year), multi-level current pattern at one location on the continental shelf.

The first step in meeting these goals was the evaluation of existing data on the physical oceanography of the South Atlantic OCS/Georgia Embayment and Blake Plateau areas. Under separate contract, all existing data will be summarized, synthesized, and evaluated with respect to overall program goals. Data gaps were determined and recommendations for filling the gaps were made for consideration in design of the continuing field effort.

FINAL REPORT:

South Atlantic OCS Physical Oceanography Final Progress Report (First Year) (SAI, 1979)

AVAILABILITY:

Available from NTIS:

Executive Summary (Vol. I) - PB80181548
Final Report (Vol. II) - PB80181555
Final Report (Vol. III) - PB80181563
Final Report (Vol. IV, Bk. 1) - On file at Minerals Management
Final Report (Vol. IV, Bk. 2) - Service, Vienna, Virginia 22180

SUMMARY:

This final progress report represents the results of the first year of a 4-year physical oceanographic and meteorological data collection effort on the outer continental shelf (OCS) from Cape Hatteras, North Carolina, to Cape Canaveral, Florida, during the period of September 1977 through November 1978. The report is to be used to provide an understanding of the currents, circulation, and mixing processes in the Georgia/Embayment/South Atlantic Bight (SAB) to assess the effects of OCS oil and gas activities on the biological environment, as well as on recreational and commercial fishing. This program will eventually lead to analytical and numerical estimation (modeling) of the SAB physical oceanography.

OTHER PUBLICATIONS/REPORTS:
(See Year 5. CT2-61)

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT0-12/29173
CT1-25/29186
CT2-61/29201
CT8-52/29138

BLM CONTRACT NO. AA551-CT8-52/MMS CONTRACT NO. 14-12-0001-29138

TITLE: South Atlantic Physical Oceanography Study (SAPOS), Year 2

DATE: 29 September 1978 - March 1981

COST: $1,178,104

PRIME CONTRACTOR:
Science Applications, Inc. (SAI)
4900 Waters Edge Drive, Suite 255
Raleigh, North Carolina 27606

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Nova University (NU)
University of Miami (UM)
North Carolina State University (NCS)
Skidaway Institute of Oceanography (SIO)

PROGRAM MANAGER:
Paul Debrule
Evans Waddell

PRINCIPAL PARTICIPANTS:
Larry Atkinson (SIO)
Phil Bedard (NU)
Otis Brown (UM)
Tom Curtin (NCS)
Peter Hamilton (SAI)
Len Pietrafesa (NCS)
James Yodder (SIO)

CONTRACTING OFFICER:
Paul Lubetkin
Carroll Day

COR: Ed Wood

OBJECTIVES:
The objective of this study were to quantify parameters needed to describe and model the Georgia Embayment/South Atlantic Outer Continental Shelf (SAOCS) region circulation and mass transport characteristics. This was a 5-year program; specific tasks for year two included:

1. Surface Currents. Deploy five radio equipped surface drogues from 5 to 14 days.

2. Subsurface Currents. Deploy one cross-shelf transect of three moorings (one year-round, the others winter & summer only).

3. Hydrography. Conduct four seasonal cruises of six transects each from Cape Fear to Cape Canaveral.

4. Gulf Stream (GS) Variability. Determine monthly GS surface characteristics using VHRR imagery.

5. Shelf Forcing Mechanisms. Obtain data from NDBO buoys, Savannah River Tower and NWS/NCC sources.

6. Meetings. Coordinate and conduct three SA OCS studies meetings.

7. MOD 1. Expand the geographic region of the hydrographic task north to Cape Hatteras and out to cross Gulf Stream. Deploy up to 12 drifters off Cape Hatteras, analyze chlorophyll a data, and include a fourth meeting.

8. MOD 2. Extend the period of performance and replacement costs for VACM (Nova University).

FINAL REPORT:

South Atlantic OCS Physical Oceanography (Second Year) (SAI, 1981)

AVAILABILITY:

Available from NTIS:
Executive Summary - PB82141862
Technical Report - PB82141870
Data Products (1) - PB82141888
Data Products (2) - PB82141896

SUMMARY:

Studies in the South Atlantic Bight (SAB) OCS were initiated to provide information for development and evaluation of acceptable operational procedures and to make management decisions. One component of this program is the Physical Oceanography Study which was designed to provide a description and understanding of circulation and mixing in the SAB/OCS, as well as an understanding of the nature and relative importance of forcing mechanisms.

The Final Report presents a summary of field activities and analyses of physical oceanographic and meteorological data collected on the outer continental shelf (OCS) from Cape Fear, North Carolina, to Cape Canaveral, Florida during the period of November 1978 through February 1980. A summary of Year II results follows:

(1) Over and along the SAB shelf, winds are similar. However, winter winds are stronger and vary regularly. Winds occuring away from the coast are generally stronger than those at the coast, and there appears to be a systematic relationship between winds measured near the coast and those measured at mid-shelf locations.

(2) The western boundary of the Gulf Stream migrates on and offshore with the larger magnitude motion occurring from the Charleston Bump northward.

(3) Gulf Stream Western Boundary (GSWB) events (eddies and filaments) are a major factor in lateral motion of the GSWB. These events have major importance to flushing, hydrography, and primary productivity in the SAB shelf.

(4) GSWB events account for most of the observed subsurface current fluctuations on the outer shelf. On the mid to inner shelf, tides and the effects of wind stress are the mechanisms which dominate observed subsurface currents.

(5) Surface water can be exchanged across the GSWB. This can be a one or two direction movement.

OTHER PUBLICATIONS/REPORTS:

(See Year 5, CT2-61)

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT0-12/29173
CT7-29
CT1-25/29186
CT2-61/29201

BLM INTERAGENCY AGREEMENT NO. AA551-IA9-24

TITLE: The Collection of Physical Oceanographic Information on the South Atlantic Outer Continental Shelf

DATE: 27 September 1979 - September 1980

COST: $60,400

PRIME CONTRACTOR: U.S. Department of Energy (DOE)

PROGRAM MANAGER:
George Saunders

CONTRACTING OFFICER:
Carroll Day

COR: Ed Wood

FINAL REPORT:
None: 12 days of ship time for data collection only.

BLM CONTRACT NO. AA851-CT0-12/29173

TITLE: South Atlantic Physical Oceanography Study (SAPOS), Year 3

DATE: 28 March 1980 - October 1982

COST: $1,079,505

PRIME CONTRACTOR:
Science Applications, Inc. (SAI)
4900 Water's Edge Drive, Suite 255
Raleigh, North Carolina 27606

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Skidaway Institute of Oceanography (SIO)
North Carolina State University (NCS)
University of Miami (UM)

PROGRAM MANAGER:
Evans Waddell

PRINCIPAL PARTICIPANTS:
Larry Atkinson (SIO)
Philip Bedard (UM)
Otis Brown (UM)
Thomas Curtin (NCS)
Peter Hamilton (NCS)
Thomas Lee (UM)
Joe Karpan (SAI)
R. Weisburg (SAI)

CONTRACTING OFFICER:
Carroll D. Day;
Jeffrey P. Petrino

COR: Edward D. Wood
Murray Brown
William H. Lang

OBJECTIVES:

The objective of this study was to quantify parameters needed to describe and model the South Atlantic Outer Continental Shelf (OCS) circulation and mass transport characteristics. This is a 5-year program. Specific tasks for year three include:

1. Subsurface Current Measurements. Deploy three moorings off Cape Romain during the GABEX I experiment (Feb.-June 1980).

2. Hydrography. Two hydrographic cruises for Blake Plateau (18 days) and North Carolina OCS (97 days).

3. Shelf Forcing Mechanisms. Obtain data from NDBO Buoys 41003, 41004, and 41005.

4. Gulf Stream Variability. Use VHRR imagery to support GABEX I and develop statistics for (GSWB) locations.

5. Meetings. Coordinate and conduct meetings at Raleigh and Charleston.

6. MOD 1. Conduct a transfer function analysis for coastal to offshore winds and determine the future need for NDBO Bucys.

7. MOD 2. Add a winter North Carolina hydrographic cruise; increase VHRR image products; and prepare uniform hydrographic data sets from the benchmark contract (CT7-2), year 1 (CT7-29)/current meter data sets for CT7-29, CT8-52.

FINAL REPORTS:

South Atlantic OCS Physical Oceanography Final Progress Report (Third Year) (SAI, 1982)

AVAILABILITY: Available from NTIS:

Executive Summary (Vol. I.) - PB83144386
Technical Report (Vol. II) - PB83144394
Data Products (Vol. III, 2 pts) - PB83144402 &
PB83144410

SUMMARY:

Volume I (Executive Summary) provides a summary of field activities and analyses of physical oceanographic and meteorological data collected on the South Atlantic Bight/outer continental shelf and Blake Plateau from January 1980 to February 1981, during Year 3 of the Physical Oceanographic Study. Project objectives, study participants, technical summaries (of Volume II reports) and planned tasks for Years 4 and 5 are provided. Listed below are some of the primary insights that have come from the Year III activities:

- The Blake Plateau has dynamic multilevel processes resulting in surface and deep mixing of water masses having diverse and often remote source regions.

- South of the Charleston Bump, much of the dominant low frequency current fluctuations of mid-shelf locations are driven by wind induced cross-shelf sloping water surfaces (barotropic flow).

- On the outer half of the shelf in the Georgia Embayment circulation, productivity, and flushing are intimately linked to stable and unstable waves forming along the Gulf Stream Western Boundary.

- Evaluation of several years of sea surface temperatures data indicate the presence of a semipermanent "kink" or meander in the annual mean position of the GSWB just downstream of the Charleston Bump.

OTHER PUBLICATIONS/REPORTS:

(See Year 5, CT2-61)

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT7-29
CT1-25/29186
CT2-61/29201
CT8-52/29138

BLM CONTRACT NO. AA851-CT1-25/MMS CONTRACT NO. 14-12-0001-29186

TITLE: South Atlantic Physical Oceanography Study (SAPOS), Year 4

DATE: 3 March 1981 - February 1983

COST: $537,921

PRIME CONTRACTOR:
Science Applications, Inc. (SAI)
4900 Water's Edge Drive, Suite 255
Raleigh, North Carolina 27606

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
University of Miami (UM)
Skidaway Institute of Oceanography (SIO)
North Carolina State University (NCS)

PROGRAM MANAGER:
Evans Waddell

PRINCIPAL PARTICIPANTS:
Larry Atkinson (SIO)
Otis Brown (UM)
Thomas Curtin (NCS)
Peter Hamilton (SAI)
Joe Karpen (SAI)
Thomas Lee (UM)
Len Pietrafesa (NCS)

CONTRACTING OFFICER:
Carroll D. Day
Jeffrey P. Petrino

COR: Ed Wood
Murray Brown
William H. Lang

OBJECTIVES:
The objective of this study was to quantify parameters needed to describe and model the South Atlantic Outer Continental Shelf (OCS) circulation and mass transport characteristics. Specific tasks for year four included:

1. Measure cross-shelf currents on the shelf break and Gulf Stream in the region of Cape Hatteras.
2. Characterize shelf-forcing mechanisms through interpretation of meteorological data buoy information.
3. Form an editorial review panel.
4. Initiate interpretation and synthesis of all data from the 4 years of field studies, and conduct two studies program meetings.

5. Conduct an OCS Reef & Hard Bottom Workshop.

FINAL REPORT:

South Atlantic OCS Physical Oceanography Final Progress Report (Year Four) (SAI, 1983)

AVAILABILITY:

Executive Summary (Vol. I) - PB83199497
Technical Report (Vol. II) - PB83199505
Data Products (Vol. III) - PB83199513

SUMMARY:

Results of the fourth year efforts of a 5-year program to study the physical oceanography of the South Atlantic Outer Continental Shelf are presented in three volumes. Volume I is an executive summary, presenting a brief summary of the study. Volume II is a detailed technical report presenting studies on the variability and range of Gulf Stream western boundary positions, effects of local wind stress on across-shelf transport and general circulation patterns, seasonal means and variance of hydrographic and current data, and a detailed analysis of forcing mechanisms and resulting circulation in the Georgia Embayment. Volume III is a compilation of fourth year field data not specifically utilized in Volume II reports and is primarily concerned with hydrographic data collected off North Carolina.

OTHER PUBLICATIONS/REPORTS:

(See Year 5, CT2-61)

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT0-12/29173
CT7-29
CT2-61/29201
CT8-52/29138

BLM CONTRACT NO. AA851-CT2-61/MMS CONTRACT NO. 14-12-0001-29201

TITLE: Completion of South Atlantic OCS Physical Oceanography Synthesis.

DATE: 29 September 1982 - October 1984

COST: $423,755

PRIME CONTRACTOR:

Science Applications, Inc. (SAI)
4900 Water's Edge Drive
Suite 255
Raleigh, North Carolina 27606

SUBCONTRACTORS/COOPERATING INSTITUTIONS:

University of Miami (UM)
Skidaway Institute of Oceanography (SIO)
North Carolina State University (NCS)

PROGRAM MANAGER:

Evans Waddell

PRINCIPAL PARTICIPANTS:

Larry Atkinson (SIO)
Otis Brown (UM)
Tom Curtin (NC)
Peter Hamilton (SAI)
Tom Lee (UM)
Len Pietrafesa (NC)

CONTRACTING OFFICER:

Jeffrey Petrino

COR: William H. Lang

OBJECTIVES:

1. Complete data analysis of previous field studies for wind-forcing mechanisms, North Carolina and Blake Plateau hydrographic cruises, and current meter results from GABEX II/G.O. 35°N array.

2. Produce a final summary report for the entire South Atlantic Physical Oceanography Study (SAPOS) in a style which presents findings geared to a technical but non-specialist reader.

3. Prepare seven technical manuscripts for submission to professional journals or publications.

FINAL REPORT:

South Atlantic Physical Oceanography Study (Year 5) (SAI, 1984)

AVAILABILITY:

Available from NTIS: Executive Summary - PB84187855
Final Report - PB84187848

SUMMARY:

Between 1977 and 1984 a physical oceanographic field measurement and data interpretation and synthesis program was conducted for an area extending alongshore from approximately Cape Hatteras to Cape Canaveral and offshore across the shelf and the Blake Plateau. Emphasis was on shelf and shelf-break processes. Primary measurements made or used extensively in one or more program years include: subsurface currents/temperature, regional/seasonal hydrography, satellite thermal imagery, coastal water levels, and coastal and marine winds. The present program was closely coordinated with a concurrent Department of Energy (DOE) funded program which studied conditions on the shelf in the Georgia Embayment. Program results describe Gulf Stream impacts on regional or process-specific circulation patterns, e.g. Gulf Stream meanders and boundary eddies or filaments. Also described is the response of shelf currents and water level to tidal and wind-stress forcing mechanisms. Satellite imagery was used in support of process studies as well as to provide a statistical description of Gulf Stream western boundary or cold wall position variability. Hydrographic cruises resolved seasonal water mass characteristics on the shelf and Blake Plateau as well as in response to local processes. Special studies were made of coastal fronts and shelf surface currents.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT0-12/29173
CT7-29
CT1-25/29186
CT8-52/29138

ADDITIONAL REPORTS AND PUBLICATIONS FROM SAPOS:

Atkinson, L.P. 1983. Distribution of Antarctic Intermediate Water over the Blake Plateau. Journal of Geophysical Research 88:4699-4704.

Atkinson, L.P. 1984. Hydrography and nutrients of the southeastern United States continental shelf. AGU Monograph series. In press.

Atkinson, L.P. and J.O. Blanton. 1984. Processes that affect stratification in shelf waters with examples from the southeastern United States continental shelf. AGU Monograph Series. In press.

Atkinson, L.P., T.N. Lee, J.O. Blanton, and W.S. Chandler. 1983. Climatology of the southeastern United States Continental Shelf Waters. Journal of Geophysical Research 88:4705-4718.

Atkinson, L.P., D.W. Menzel and K.A. Bush. 1984. Oceanography of the southeastern United States continental shelf. AGU Monograph Series. In press.

Atkinson, L.P., P.G. O'Malley, J.A. Yoder and G.A. Paffenhofer. 1984. The effect of summertime shelf break upwelling on nutrient flux in southeastern United States continental shelf waters. Journal of Marine Research, 42:969-993.

Atkinson, L.P., J.A. Yoder and T.N. Lee. 1984. Review of upwelling off the southeastern United States and its effect on continental shelf nutrient concentrations and primary productivity. Rapp. P.-v Reun. Cons. int. Explor. Mer, 183:70-78.

Blanton, J., L. Atkinson, L. Pietrafesa and T.N. Lee. 1981. The intrusion of Gulf Stream water across the continental shelf due to topographicinduced upwelling. Deep-Sea Research 28(AA):393-405.

Hamilton, P. 1984. Hindcasting offshore winds in the South Atlantic Bight. Submitted to Monthly Weather Review.

Hamilton, P. 1984. The structure of shelf and slope circulation in the Georgia Bight. (manuscript).

Kourafalou, V., J.D. Wang, and T.N. Lee. 1984. Circulation on the Southeast U.S. Continental Shelf, Part III - Circulation model with application to the winter wind-driven flow. Journal of Physical Oceanography 14(6):1022-1031.

Leamon, K.D., T.N. Lee and R. Findley. 1983. Performance of an experimental Aanderaa current meter modified for near-surface measurements. Marine Technology Society 17(1):54-38.

Lee, T.N. and L.P. Atkinson. 1982. On Gulf Stream frontal eddies along the southeast U.S. outer continental shelf. In Workshop on Naval Gulf Stream Structure and Variability - Proceedings, Office of Naval Research, Research Triangle, NC, April 1982, pp. 182-222.

Lee, T.N. and L.P. Atkinson. 1983. Low frequency current and temperature variability from Gulf Stream frontal eddies and atmospheric forcing along the southeast U.S. Outer Continental Shelf. Journal of Geophysical Research 88:4541-4567.

Lee, T.N., L.P. Atkinson and R. Legneckis. 1981. Observations of a Gulf Stream frontal eddy on the Georgia continental shelf, April 1977. Deep-Sea Research 28A:347-348.

Lee, T.N., E. Daddio, and G.C. Han. 1982. Steady-state diagnostic model of summer mean circulation on the Georgia Shelf. Journal of Physical Oceanography 12:820-838.

Lee, T.N., W.J. Ho, V. Kourafalou, and J.D. Wang. 1984. Circulation on the southeast U.S. Continental Shelf, Part I - Subtidal response to wind and Gulf Stream forcing. Journal of Physical Oceanography 14(6):1001-1012.

Lee, T.N., V. Kourafalou, J.D. Wang, W. Ho, J.O. Blanton, L.P. Atkinson, and L.J. Pietrafasa. 1985. Shelf circulation from Cape Canaveral to Cape Fear during winter. In American Geophysical Monograph, Chapter 4, (in press).

Lee, T.N., and E. Waddell. 1983. On Gulf Stream variability and meanders over the Blake Plateau at 30°N. Journal of Geophysical Research 88(C8):4617-4632.

Li Li, M. Wimbush, and T.N. Lee. 1984. Low-frequency current variability on the Georgia continental shelf, winter 1978. Journal of Geophysical Research (in press).

Olson, D.B., O.B. Brown, and S.R. Emmerson. 1983. Gulf Stream derived from satellite and historical data. Journal of Geophysical Research 88:4569-4577.

Pietrafesa, L.J. 1983. Survey of a Gulf Stream filament. Geophysical Research Letters 10:203-206.

SAIC. 1981. Summary of Results of Reefs and Hardgrounds Workshops, Duke Univ. Mar. Lab., Sept. 23-24, 1981, V. J. Henry, Chairman. Unpublished Report, 44 p.

Singer, J.J., L.P. Atkinson, J.O. Blanton, and J.A. Yoder. 1983. Cape Romain and the Charleston Bump: historical and recent hydrographic observations. Journal of Geophysical Research 88:4685-4697.

Wang, J.D., V. Kourafalou, and T.N. Lee. 1984. Circulation of the Southeast U.S. Continental Shelf, Part II - Model development and application to tidal flow. Journal of Geophysical Research 14(6):1013-1021.

Weisberg, R.H. and L.J. Pietrafesa. 1983. Kinematics and correlation of the surface wind field in the South Atlantic Bight. Journal of Geophysical Research 88:4593-4610.

Yoder, J.A., L.P. Atkinson, S.S. Bishop, E.E. Hofmann, and T.N. Lee, 1983. Effect of up welling on phytoplankton productivity of the outer southeastern United States Continental Shelf. Continental Shelf Research 1:385-404.

BLM CONTRACT NO. AA851-CT0-35/MMS CONTRACT NO. 14-12-0001-29176

TITLE: Blake Plateau Bottom and Mid-Water Current Study, Year 1

DATE: 27 May 1980 - September 1982

COST: $359,319

PRIME CONTRACTOR:

General Oceanics, Inc. (GOI)
1295 NW 163rd St.
Sunshine State Industrial Park
Miami, Florida 33169

SUBCONTRACTORS/COOPERATING INSTITUTIONS:

University of Miami (UM)

PROGRAM MANAGER:

Chris Casagrande

PRINCIPAL PARTICIPANTS:

Tom Lee (UM)

CONTRACTING OFFICER:

Carroll D. Day
Jeffrey P. Petrino

COR:

Ed Wood
Murray Brown
William H. Lang

OBJECTIVES:

1. Deploy five moorings along 30°N lat (70-970m) for 1 year.
2. Establish a physical oceanographic data base to provide both information for initializing and calibrating a prognostic numerical model of South Atlantic Bight/Blake Plateau processes, and independent estimates of key processes active in the area.

FINAL REPORT:

Blake Plateau: Mid-depth and bottom current measurements (GOI, 1982)

AVAILABILITY:

Available from NTIS: Final Report PB83144519

SUMMARY:

General Oceanics, Inc., under a Minerals Management Service (MMS) (formerly Bureau of Land Management) contract, anchored five moorings instrumented with current meters across the Blake Plateau along latitude 30°N (fig. 13). The water depths range from 70 to 970 meters.

The data collected from the 12-month field study are to be used to verify the performance of a numerical model, also supported by the MMS, representing circulation in the South Atlantic Bight.

One current meter was placed near the anchor of each mooring. Two of the moorings intended for anchorage under the Gulf Stream had an additional current meter attached at 200 meters and another at 400 meters above the bottom current meter.

The data from these upper meters clearly defined the Gulf Stream as a strong northward flow whose meanders created speed and temperature fluctuations representing 40-70 percent of the total variance recorded. Many of these meanders appear to have been produced by energy fluctuations occurring at 2-to 14-day intervals. These results agree remarkably well with those of other researchers.

Near-bottom flows on the two Blake Plateau moorings east of the Gulf Stream displayed prolonged southward flow events lasting up to 42 days and reaching speeds in excess of 30 cm sec^{-1}. These events did not correlate with flows at the other three sites. The generating mechanism behind these southward flows is not clear and further work will have to be performed in order to characterize the responsible mechanism.

OTHER PUBLICATIONS/REPORTS:

Lee, T. N. and E. Waddell, 1983. On Gulf Stream variability and meanders over the Blake Plateau at 30°N. J. Geophys. Res. 88: 4617-4631.

Lee, T. N. and E. Waddell, 1982. On Gulf Stream variability at 30° N. In: Workshop on Gulf Stream structure and variability - Proceedings, The Office of Naval Research, Research Triangle Park, NC, April 1982, pp. 223-253.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-33/29187
CT2-62/29202

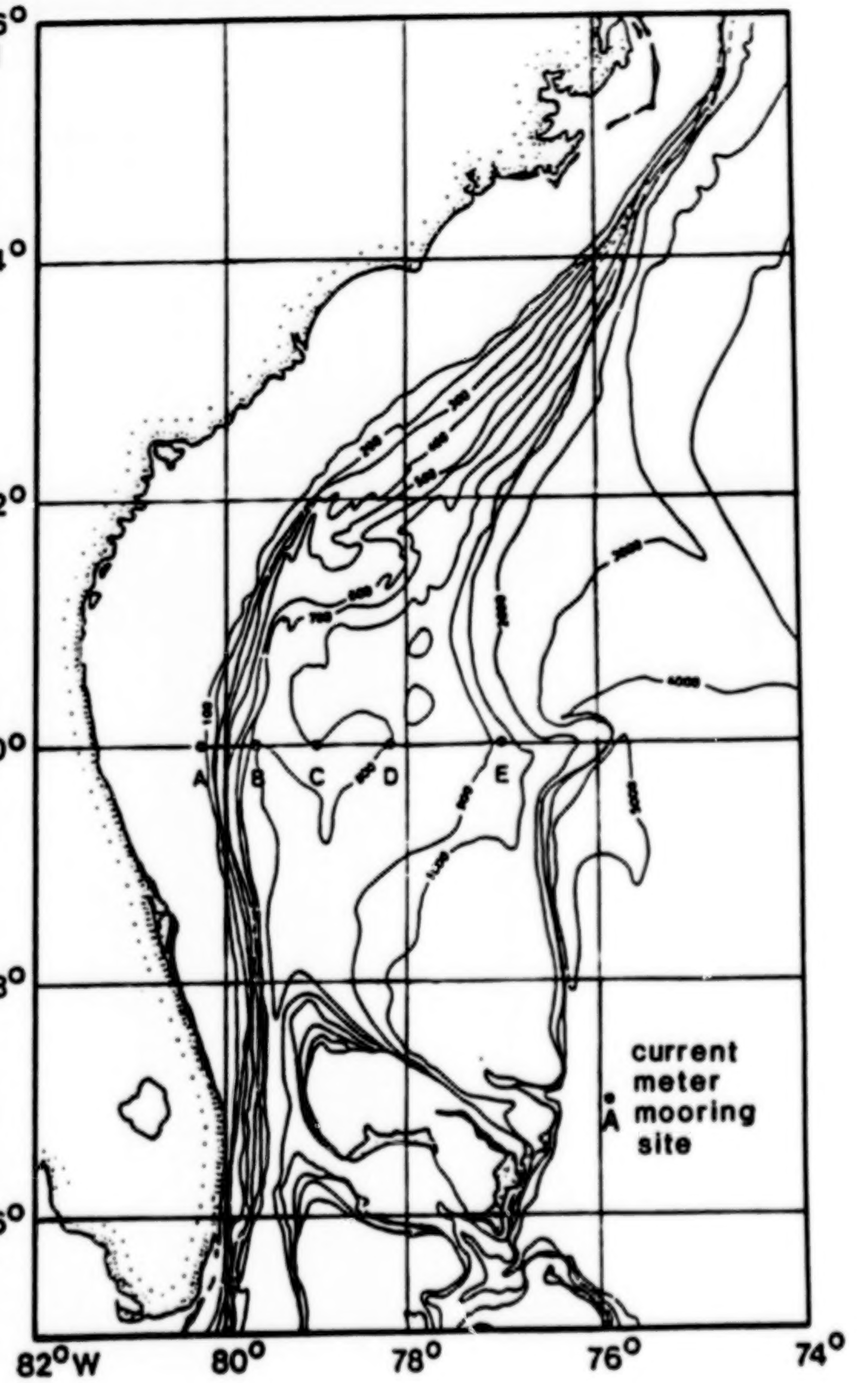

Figure 13. Location of Blake Plateau current meter mooring sites: August 26, 1980 to October 6, 1984.

BLM CONTRACT NO. AA851-CT1-33/MMS CONTRACT NO. 14-12-0001-29187

TITLE: Blake Plateau Bottom and Mid-Water Current Study, Year 2

DATE: 3 March 1981 - March 1983

COST: 383,851

PRIME CONTRACTOR:
General Oceanics, Inc. (GOI)
1295 NW 163rd Street
Miami, Florida 33169

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
University of Rhode Island (URI)

PROGRAM MANAGER:
Chris Casagrande

PRINCIPAL PARTICIPANTS:
Randy Watts (URI)

CONTRACTING OFFICER:
Carroll Day
Jeffrey P. Petrino

COR: Ed Wood
Murray Brown
William H. Lang

OBJECTIVES:

1. Measure near-bottom currents along a transect at 36°N for a period of 1 year to compliment hydrographic measurements for use in circulation modeling.
2. Deploy five moorings along 36°N lat (100-3600 m) from 1 May 1981 to 9 June 1982.

FINAL REPORT:

Blake Plateau: near bottom current/temperature measurements on 36°N (GOI, 1983)

AVAILABILITY: Available from NTIS: Final Report - PB83205047

SUMMARY:

Near bottom current/temperature measurements were made over a 1-year period at five locations from the shelf break to approximately 3,000 m water depth along 36°N (fig. 14). On each of the five moorings, instruments were positioned about 100 m off the bottom. This elevation was chosen to reduce the bottom boundary layer as well as any local bathymetric irregularities. All the resulting velocity/temperature data were analyzed and evaluated to create a first order description of conditions which occurred during the study.

The instruments deployed were able to characterize mean flow and variability of the Western Boundary Under Current (WBUC). The shelf break site showed a mean southward flow, which is consistent with previous observations that in the Mid-Atlantic Bight, shelf water is transported to the south. The mid-three mooring positions were all within the WBCU with the strongest equator ward flow occurring at the middle site (Site H, 2277 m). Site I (3090 m) appears near the eastern boundary of the WBUC, and lateral shifts caused this site to experience, periodically, the associated colder water and stronger equatorward flow. The seaward mooring (J, 3700 m) is generally outside the WBUC.

At these current meter sites, several major changes correspond to lateral shifts of the Gulf Stream path. The pattern of change is consistent with a remarkably simple description: beneath the Gulf Stream a narrow region of northeastward flow seems to extend to the ocean floor. The boundary between this and the WBCU is normally between sites I and J, but shifts together with the near-surface Gulf Stream path. When the Stream is offshore of site I, the currents at that site are predominantly southward and temperatures are relatively cold. When the stream moves onshore of site I, the corresponding currents are weak and variable, or sometimes northward and temperatures are warmer.

For comparison, this report also contains results of other studies conducted in the area. For example, one earlier study just south of the area (fig. 15) generally supports the finding of the work reported here.

OTHER PUBLICATIONS/REPORTS:

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT0-35/29176
CT2-62/29202

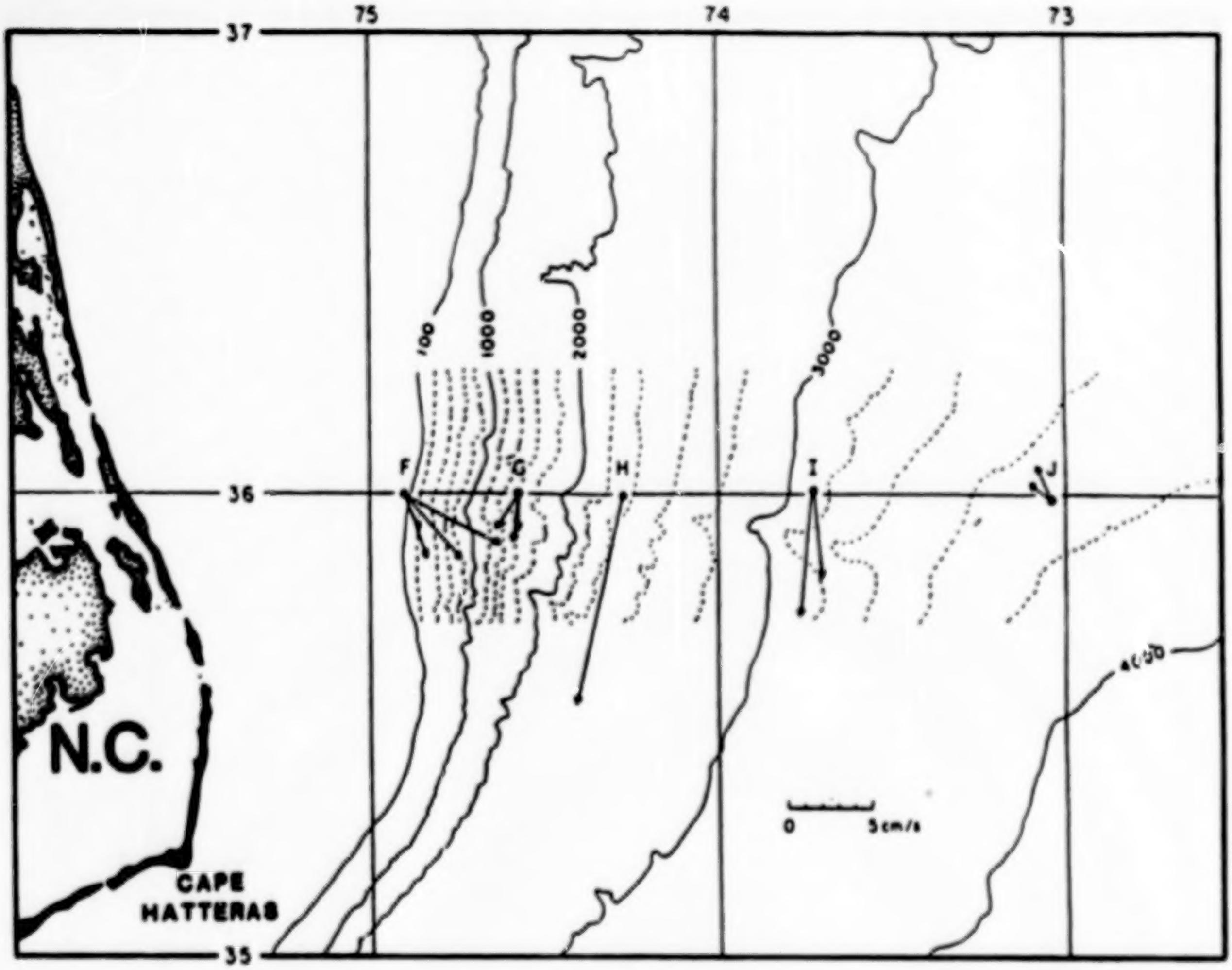

Figure 14. Mooring locations F, G, H, I and J along 36 deg. N off Cape Hatteras, N.C. Bathymetric contours are shown in 200m intervals. The mean current vector for each record deployment period is plotted. The speed scale is at the lower right.

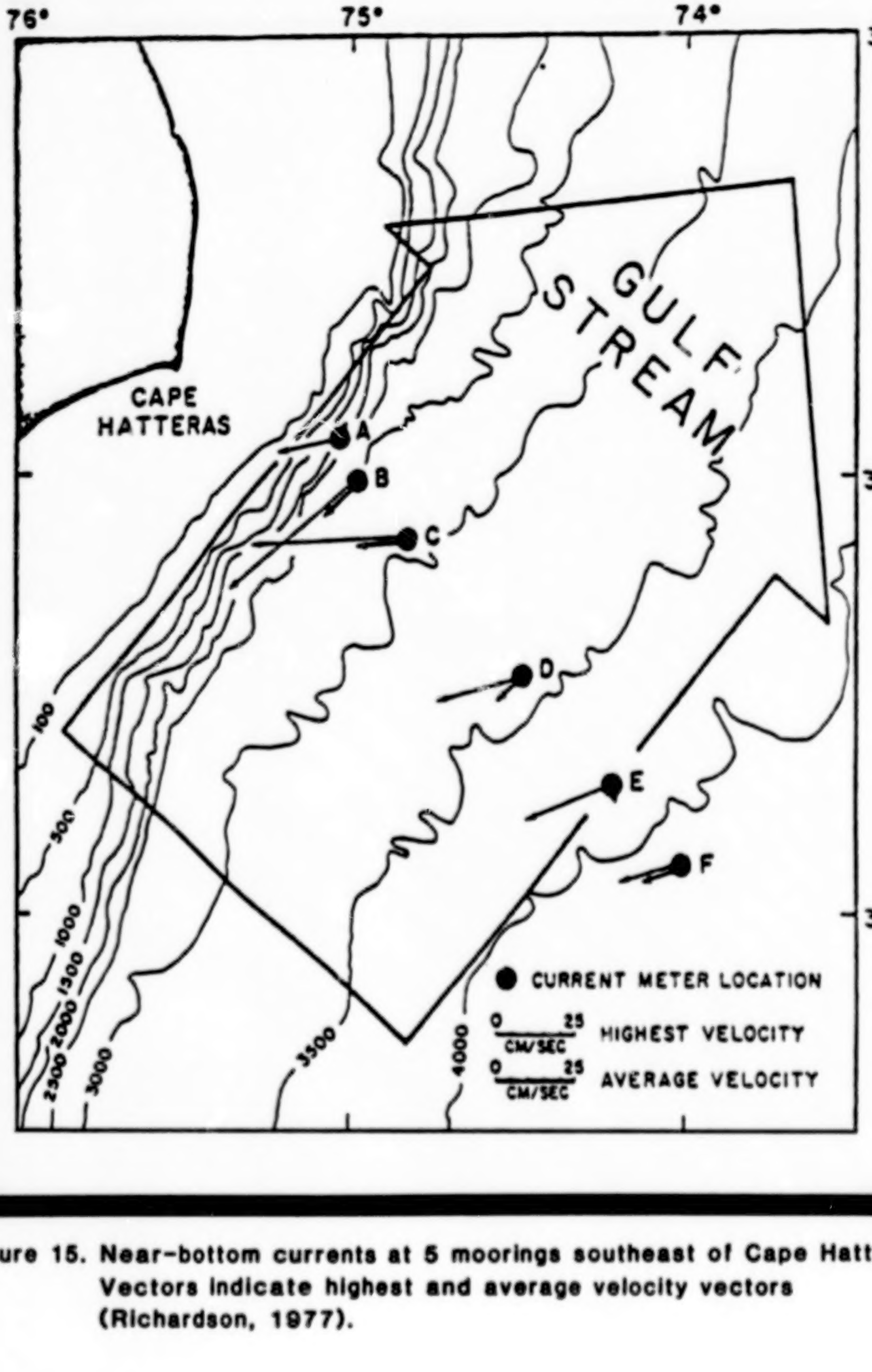

Figure 15. Near-bottom currents at 5 moorings southeast of Cape Hatteras. Vectors indicate highest and average velocity vectors (Richardson, 1977).

BLM CONTRACT NO. AA851-CT2-62/MMS CONTRACT NO. 14-12-0001-29202

TITLE: Continued Blake Plateau Current Measurement Study,
Year 3

DATE: 30 September 1982 - December 1985

COST: $3,056,045

PRIME CONTRACTOR:
General Oceanics, Inc. (GOI)
1295 NW 163rd Street
Miami, Florida 33169

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
University of Miami (UM)
Skidaway Institute of Oceanography (SIO)
Applied Science Associates (ASA)

PROGRAM MANAGER:
Dr. Gregory Han

PRINCIPAL PARTICIPANTS:
Larry P. Atkinson (SIO)
Otis B. Brown (UM)
Thomas N. Lee (UM)
Craig Swanson (ASA)
James Yodder

CONTRACT SPECIALIST:
Jeffrey P. Petrino

COR: James Lane

OBJECTIVES:
The objectives of this study are to:

1. Determine the amplitude, speed, and direction of the Gulf Stream on time scales from hours to seasons.

2. Describe and quantify the current and temperature variability of the Gulf Stream in the vertical and horizontal plane (fig. 16).

3. Identify and describe the dominant physical processes producing the observed Gulf Stream variability and determine their spatial and temporal scales.

4. Determine Gulf Stream influences on the physical oceanography of the South Atlantic Outer Continental Shelf (OCS).

5. Determine the importance of eddy-induced upwelling to primary productivity.

FINAL REPORT:

Draft due 15 December 1985 (semiannual reports every 6 months).

AVAILABILITY:

SUMMARY:

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT0-35/29176
CT1-33/29187

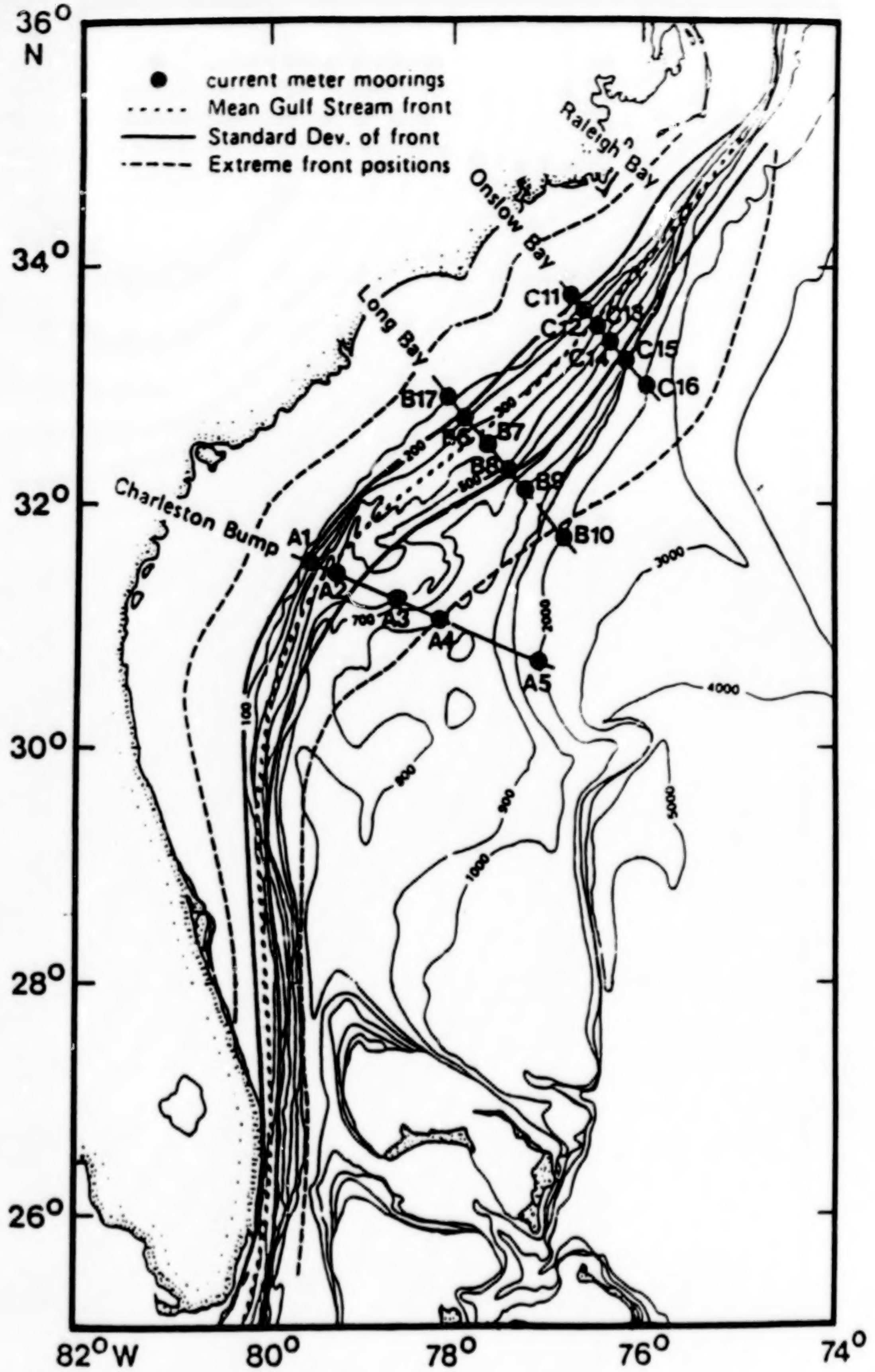

Figure 16. Location of current meter moorings with statistics of satellite derived Gulf Stream cyclonic front positions.

MMS CONTRACT NO. 14-12-0001-30082

TITLE: Florida Atlantic Coast Transport Study (FACTS)

DATE: January 1984 - July 1985

COST: $2,102,004 (Estimated)

PRIME CONTRACTOR:
Florida Institute of Oceanography (FIO)
830 First Street, South
St. Petersburg, Florida 33701

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Atlantic Oceanographic and Meteorological Lab. (AMOL)
Florida A&M University (FAMU)
General Oceanics (GO)
Harbor Branch Foundation (HBF)
University of Miami (UM)
University of South Florida (USF)

PROGRAM MANAGER:
Murice Rinkel/Sandra Vargo

PRINCIPAL PARTICIPANTS:
Chris Casagrande (GO)
A. D. Kirwan
Kevin Leaman (UM)
Tom Lee (UM)
George Maul
John Proni (AOML)
Friederich Schott (UM)
Ned Smith (HBF)

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: James Lane

OBJECTIVES:
The objectives of this study are to:

1. Determine the frequencies and location of filament structures on the western edge of the Gulf Stream between 31 degrees and 27 degrees N latitude along the Atlantic coast of Florida.
2. Produce the data on the frequencies and location of filament structures in a format that is directly compatible with the circulation model of the South Atlantic prepared by Dynalysis of Princeton.
3. Incorporate the results from this study with those of other physical oceanography studies of the Atlantic Continental Shelf of Florida in a synthesis of available information on the principal water masses and their circulation patterns in the region (fig. 17).

FINAL REPORT:
Due July 1985

AVAILABILITY:

SUMMARY:

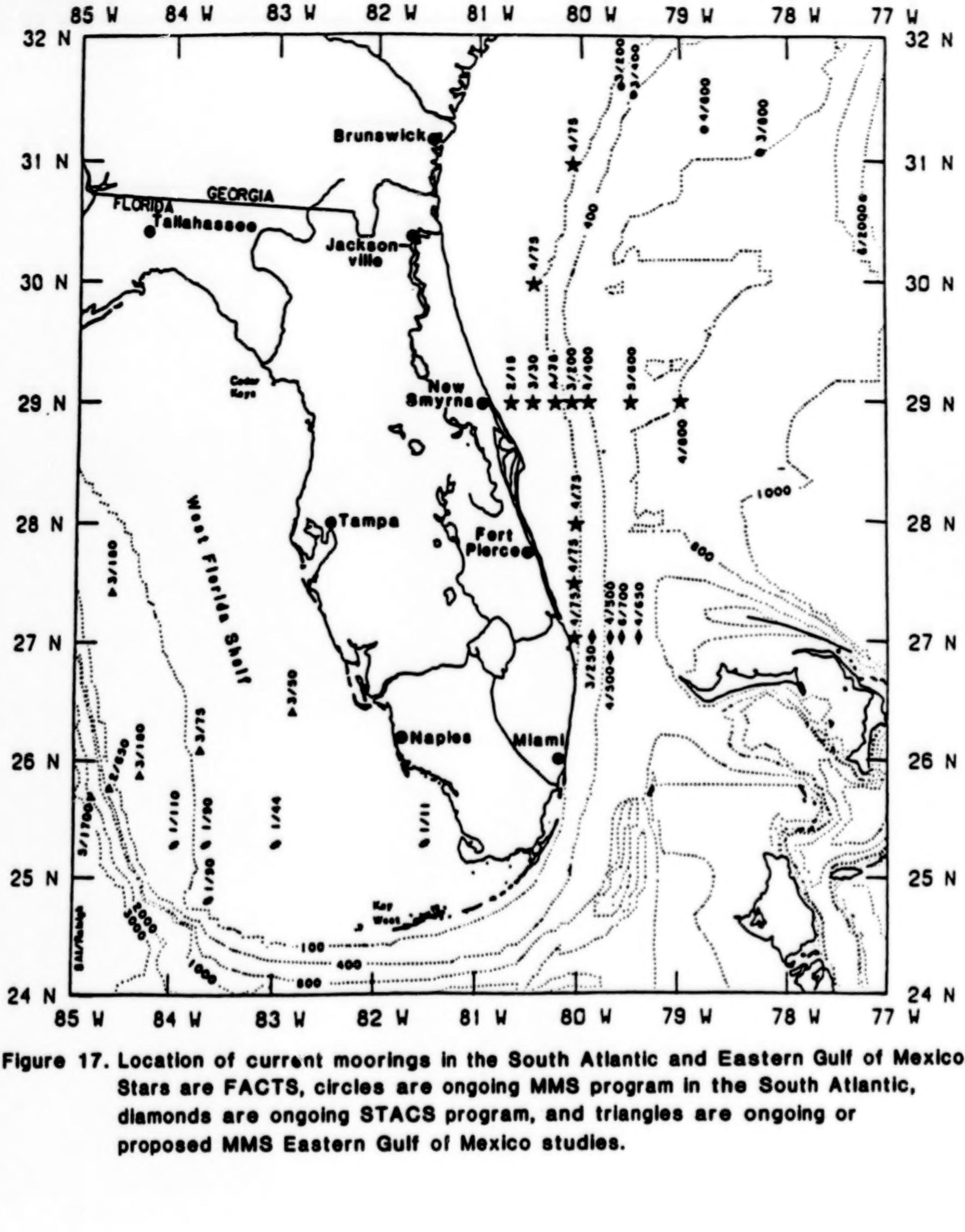

Figure 17. Location of current moorings in the South Atlantic and Eastern Gulf of Mexico. Stars are FACTS, circles are ongoing MMS program in the South Atlantic, diamonds are ongoing STACS program, and triangles are ongoing or proposed MMS Eastern Gulf of Mexico studies.

BLM CONTRACT NO. AA551-CT9-32/MMS CONTRACT NO. 14-12-0001-29170

TITLE: Application of a Coastal Circulation Model to the South Atlantic Outer Continental Shelf

DATE: 25 September 1979 - April 1982

COST: $407,922

PRIME CONTRACTOR:
Dynalysis of Princeton
20 Nassau Street
Princeton, New Jersey 08540

PROGRAM MANAGER:
H. James Herring

PRINCIPAL PARTICIPANTS:
Alan F. Blumberg
Lakshmi H. Kantha
George L. Mellor

CONTRACTING OFFICER:
Carroll D. Day
Linda J. DeRamus
Jeffrey Petrino

COR: Edward D. Wood
William H. Lang

OBJECTIVES:

1. Provide a working descriptive and predictive computer model which allows reasonably accurate predictions of such things as: surface current velocities for input into trajectory models; mid-water circulation to predict dissolved and suspended matter transport; and near-bottom currents to predict sediment transport.

2. Adapt this model to the South Atlantic Outer Continental Shelf (OCS) region, test the model with existing data, and provide quantitative values of seasonal circulation for use with the Minerals Management Service (MMS) oil-spill risk analysis model.

FINAL REPORT:

South Atlantic Bight Numerical Model Application (Dynalysis Report No. 63) (L. H. Kantha, 1980)

A Diagnostic Ray-Tracing Scheme for Deducing the Climatological Current Distribution in the South Atlantic Bight (Dynalysis Report No. 64) (L. H. Kantha, 1980)

A Diagnostic Technique for Deducing the Climatological Circulation as Applied to the South Atlantic Bight (Dynalysis Report No. 69) (L. H. Kantha, A. F. Blumberg, G. L. Mellor; 1981)

The Physical Oceanographic and Sea Surface Flux Climatology of the South Atlantic Bight (Dynalysis Report No. 70) (L. H. Kantha, A. F. Blumberg, H. J. Herring, G. L. Mellor, 1981)

Circulation Studies in the South Atlantic Bight with diagnostic and prognostic numerical models (Dynalysis Report No. 71) (A. F. Blumberg, G. L. Mellor, 1981)

South Atlantic Bight Numerical Model Application - Executive Summary (Dynalysis Report No. 72) (A. F. Blumberg, H. J. Herring, L. H. Kantha, G. L. Mellor; 1981)

AVAILABILITY:

Available from NTIS:
Executive Summary (Dynalysis Rep. 72) - PB83143297
Final Report (Dynalysis Rep. 63) - On file at Minerals Management
Final Report (Dynalysis Rep. 64) - Service in Vienna, Virginia 22180
Final Report (Dynalysis Rep. 69) - PB3143263
Final Report (Dynalysis Rep. 70) - PB3143271
Final Report (Dynalysis Rep. 71) - PB3143289

SUMMARY:

Circulation of the water masses in the South Atlantic Bight (SAB) has been modelled using a three-dimensional, physically comprehensive General Circulation Model (GCM) that incorporates realistic turbulent mixing and air-sea momentum, heat, and mass transfer. Open ocean boundary conditions for this model have been deduced from a Characteristic Tracing Model (CTM 81) that uses simplified physics to drive the currents from prescribed water density and sea-surface wind stress fields. An atlas of the physical oceanographic and sea-surface flux climatology of the SAB has also been prepared from a data base derived from National Climatic Center and National Oceanographic Data Center historical observation data.

The two models in consort with each other provide current distributions in the SAB at various depths in the water column. The capabilities of the models have been demonstrated by deducing the circulation distribution for typical seasons. The CTM 81 has been used to derive the prevailing 'climate' of the SAB currents, whereas the GCM has been run in both prognostic (forecast) and diagnostic (hindcast) modes. The resulting circulation agrees well with available observations.

OTHER PUBLICATIONS/REPORTS:

Blumberg, A.F. and G. L. Mellor, 1983. A description of a three-dimensional coastal ocean circulation model. In N. Heaps, ed., Three-Dimensional Shelf Models, Coastal and Estuarine Sciences, American Geophysical Union, Vol. 5.

Blumberg, A. F. and G. L. Mellor, 1983. Diagnostic and prognostic numerical circulation studies of the South Atlantic Bight. J. Geophys. Res. 88:4579-4592.

Kantha, L. H., G. L. Mellor, and A. F. Blumberg, 1981. Diagnostic calculations of the circulation in the Middle and South Bights. Ocean Modeling 37:5-11.

Kantha, L. H., G. L. Mellor, and A. F. Blumberg, 1982. A diagnostic calculation of the general circulation in the South Atlantic Bight. J. Phys. Oceanogr. 12:805-819.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT2-85/29203

BLM CONTRACT NO. AA851-CT2-85/MMS CONTRACT NO. 14-12-0001-29203

TITLE: South Atlantic Outer Continental Shelf Circulation Model Phase III.

DATE: 30 September 1982 - July 1985

COST: $339,089

PRIME CONTRACTOR:
Dynalysis of Princeton
219 Wall Street
Princeton, New Jersey 08540

PROGRAM MANAGER:
H. James Herring

PRINCIPAL PARTICIPANTS:
Alan F. Blumberg
Lakshmi Kantha
George L. Mellor

CONTRACTING OFFICER:
Fred M. Galinsky

CONTRACT SPECIALIST:
Jeffrey P. Petrino

COR: James Lane

OBJECTIVES:
The objectives of this program are to:

1. Develop an understanding of the physical and climatological factors that drive circulation along the east coast of the United States, and with that knowledge produce meaningful models that predict the movement and eventual fate of materials discharged into the ocean as a result of outer continental shelf (OCS) activities.

2. Update the climatological data base used in earlier phases of the program to develop these circulation models-General Circulation Model (GCM) and Characteristic Tracing Model (CTM).

3. Improve these models through reformulations, boundary and grid modifications, and continuation of validation/evaluation efforts.

4. Expand the models to include the Florida Straits region and incorporate data bouy information from the Florida Atlantic Coast Transport Study (FACTS) program (contract no. 30082).

5. Test the GCM using a finer grid to determine its ability to predict event features of the Gulf Stream, such as meanders and eddy shedding.

FINAL REPORT:

Kantha, L. H., A. F. Blumberg, H. J. Herring, and G. L. Mellor, 1983. South Atlantic OCS Circulation Model Phase III.

AVAILABILITY:

A review copy is available at the Minerals Management Service, Vienna, Virginia.

SUMMARY:

Two different, but conceptually related, models have been refined and applied to deducing the circulation along the entire east coast of the United States, including the South Atlantic Bight (SAB). The model simulations are based upon the extensive hydographic data sets assembled from both national archives (National Oceanographic Data Center and Fleet Numerical Oceanography Center) and local sources including the observational projects supported by the Minerals Management Service. These data have been subjected to a comprehensive data analysis procedure to produce climatological distributions of the various water mass characteristics, wind stresses, and heat fluxes.

The Characteristic Tracing Model (CTM 81), based on geostrophic/Ekman dynamics developed previously has been extended to include the effect of bottom stresses in the planetary potential vorticity balance. A turbulence mixing model based on second moment techniques of turbulence closure incorporated into the model takes into account the influence of the wind and bottom stresses on the currents. The enhanced model, CTM 83 is designed to provide a diagnostic means for deducing the transports and currents in the water column from the prescribed hydographic and surface wind data. This report describes the results of the CTM 83 applied to the East Coast of the United States, with primary emphasis on the South Atlantic Bight. Both the seasonal variations and overall climatological values of the currents and transports are presented.

The East Coast region also exhibits considerable temporal variability so that the use of an already existing SAB General Circulation Model (GCM) is appropriate. After configuring the model for high resolution (approx. 5-km grid spacing), it was prudent to investigate in a simpler context some of the characteristics of eddy generation and propagation. Idealized experiments with the external mode component of the full model, run in a reduced gravity mode, demonstrate that when a Gulf Stream flow is forced around a topographic feature, intense eddies develop spontaneously; however, when the same flow traverses a region without such a feature no eddies are produced.

OTHER PUBLICATIONS/REPORTS:

See list for Contract Number CT9-32.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT9-32/29170

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SOUTH ATLANTIC

Biology

BLM CONTRACT NO. AA550-CT7-02

TITLE: South Atlantic OCS Benchmark Study, FY 1977

DATE: November 1976 - September 1978

COST: $4,055,342

PRIME CONTRACTOR:

Texas Instruments, Incorporated (TI)
Dallas, Texas 75265

OBJECTIVES:

1. Determine the range of concentrations of high molecular weight hydrocarbons (HMWHC) and selected trace metals (TM) in the water, sediments, zooplankton community, and selected macro-epifaunal animals.

2. Determine natural variation in structure, abundance, distribution, and similarity of components of the benthic community.

3. Describe zooplankton communities over the continental shelf, as well as their structure, abundance, and variation.

4. Enumerate heterotrophic microorganisms; identify dominant species in surface film, near-surface water, and sediments; evaluate the oil-degrading potential of the organisms; and examine the relationship of numbers of hydrocarbon-using aerobic, heterotrophic bacteria to oil concentration in the natural environment.

5. Measure and describe concentrations of chlorophyll a, dissolved oxygen, salinity, temperature, nutrients, and particulate and total organic carbon in the water column.

FINAL REPORT:

South Atlantic OCS Benchmark Program 1977 Report (TI, 1979)

AVAILABILITY:

A review copy is available at the Minerals Management Service,
Vienna, Virginia 22180

SUMMARY:

Data in support of the study objectives were collected during four seasonal oceanographic cruises in the study area (fig. 18) , and in subsequent laboratory analyses. The results of these efforts provide a benchmark study for the South Atlantic/Georgia Bight region.

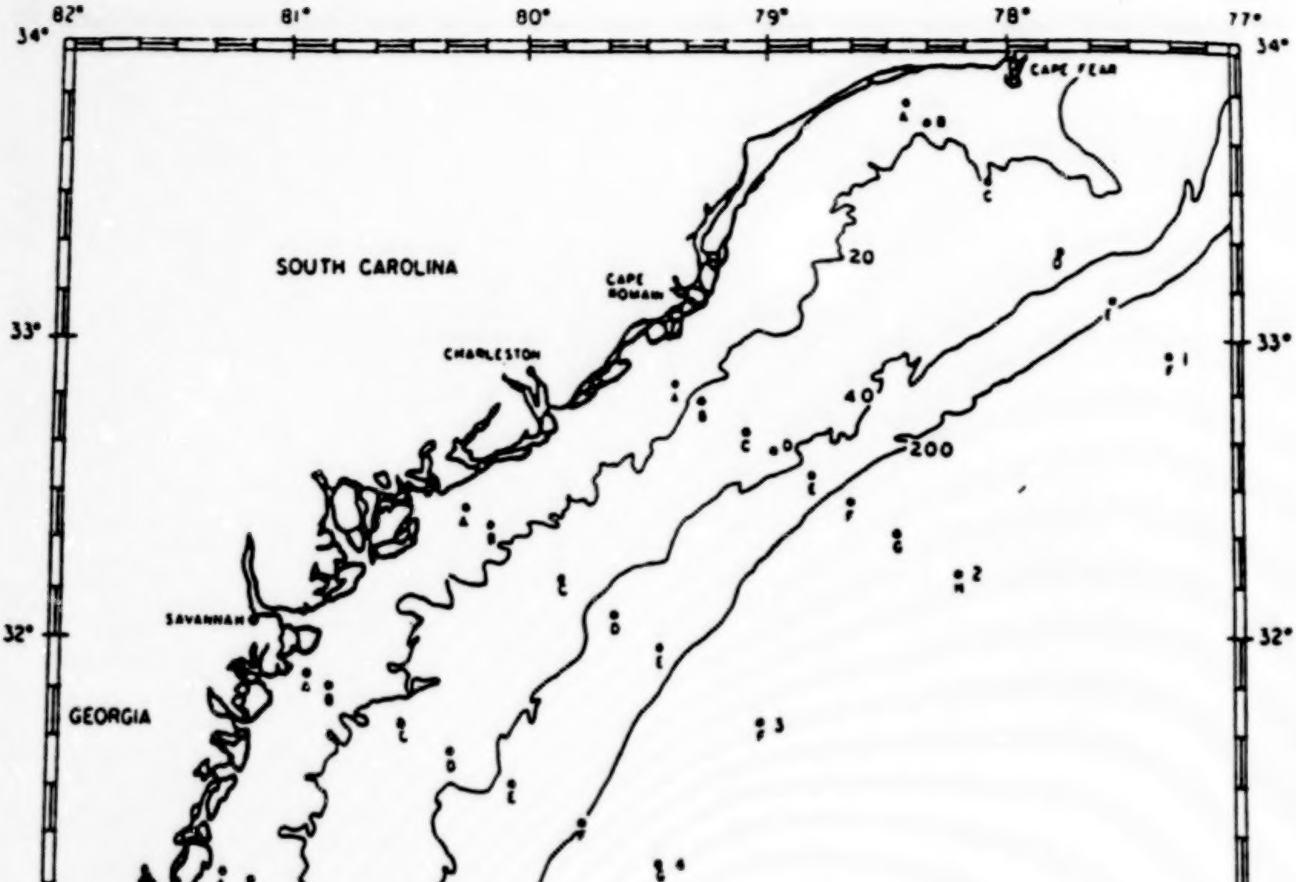

Figure 18. SABP Study Area and Sampling Stations.

BLM CONTRACT NO. AA551-CT8-25

TITLE: South Atlantic Hard Bottom Study

DATE: July 1978 - October 1979

COST: $235,968

PRIME CONTRACTOR:
Continental Shelf Associates, Inc. (CSA)
P.O. Box 3609
Tequesta, Florida 33458

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Decca Survey Systems, Inc. (DSS)

PROGRAM MANAGER:
Robert C. Stevens, Jr.

PRINCIPAL PARTICIPANTS:
Dennis J. Adamek
John W. Antoine (DSS)
Frederick B. Ayer (CSA)
David A. Gettleson (CSA)
Thomas E. Neurauter (DSS)
Russell Putt (CSA)

OBJECTIVES:
The primary objectives of this study were to determine if the geologic hazards survey records to be collected in the Georgia Bight would be adequate for defining the locations of hard bottoms. The secondary objectives of this study were to:

1. Characterize the substrate comprising the hard bottom through petrographic analyses.

2. Identify the hard-bottom associated epifauna and demersal fishes.

FINAL REPORT:
South Atlantic Hard Bottom Study (CSA, 1979)

AVAILABILITY:
Available from NTIS:
Final Report - PB300821

SUMMARY:

Four oil and gas lease blocks in the Georgia Embayment were surveyed with a precision depth recorder, side scan sonar, and subbottom profiler for the purpose of identifying and mapping areas of hard bottom. The primary objective of this study was to determine the efficacy with which standard geophysical equipment and techniques could identify and map hard bottom areas. In addition, the hard bottom substrate and associated fauna were identified and described from dredge samples and color photographs.

Inspection of geophysically mapped hard bottom areas with an underwater television camera system showed that, through the conservative interpretation of side scan sonar signatures and identification of areas of apparent outcropping of subbottom profiler, hard bottom areas can be geophysically mapped most successfully.

Petrographic analysis of 43 rock samples dredged from the hard bottom areas showed that the hard bottom was principally a recent to subrecent biostromal reef. Six lithologic types (sandstone, biomicrite, sandy biomicrite, biosparite, biolithite, and algal biolithite) were identified from the dredge samples with no significant variations in their distribution recorded between the four lease blocks.

Four hundred and ninety-nine taxa, including 33 fish species, were identified from 68 biological dredge samples collected in hard bottom areas. Faunal assemblages that were identified appeared to be directly correlated with substrate type, however, water depth seemed to be a major factor influencing the abundance and distribution of the observed and collected species as well.

OTHER PUBLICATIONS/REPORTS:

Gettleson, D. A., R. A. Hammer, and R. E. Putt, 1982. Geophysical and biological seafloor mapping of four oil and gas lease blocks in the South Atlantic Georgia Embayment. In: Oceans '82 Conference Record, Marine Technology Society, Washington, D.C. p. 803-808.

Gettleson, D.A, N.W. Phillips, and R.M. Hammer, 1985. Dense polychaete (Phyllochaetopterus socialis) mats on the South Carolina Continental Shelf. Northeast Gulf Science, vol. 7, no. 2, p. 167-170.

BLM CONTRACT NO. AA851-CT9-27/MMS CONTRACT NO. 14-12-0001-29168

TITLE: South Atlantic OCS Area Living Marine Resources Study, Year 1

DATE: 9 September 1979 - 4 October 1982.

COST: $738,347

PRIME CONTRACTOR:
South Carolina Wildlife & Marine Resources Dept. (SCMDR)
P.O. Box 12559
Charleston, South Carolina 29142

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Duke University Marine Laboratory (DUML)
Georgia Coastal Resources Division (GCRD)

PROGRAM MANAGER:
Project Leader - Victor G. Burrell, Jr.
Project Coordinator - Robert Van Dolah

PRINCIPAL PARTICIPANTS:
David Ansley (GCRD)
Charles A. Barans (SCMDR)
Billy B. Boothe (GCRD)
Dale R. Calder (SCMDR)
Alfred G. Gash (SCMDR)
Charles D. Harris (GCRD)
William W. Kirby-Smith (DUML)
David N. Knott (SCMDR)
Robert K. Mahood (GCRD)
John J. Manzi (SCMDR)
Robert Matheson (DUML)
Thomas D. Mathews (SCMDR)
John V. Miglarese (SCMDR)
M. B. Morehead (GCRD)
Paulette Peckol (DUML)
Jeanette H. Phillips (GCRD)
Robert J. Reimold (GCRD)
Steve Ross (DUML)
Richard Searles (DUML)
George R. Sedberry (SCMDR)
Frank W. Stapor (SCMDR)
B. W. Stender (SCMDR)
Charles A. Wenner (SCMDR)
Elizabeth L. Wenner (SCMDR)

CONTRACTING OFFICER:
Carroll D. Day
Frances L. Sullivan

COR: Mark J. Grussendorf
Ed Wood
Robert M. Avent
Jeffrey L. Hyland

OBJECTIVES:

1. Define the fish and invertebrate assemblages inhabiting nine live bottom sites in the South Atlantic Outer Continental Shelf (OCS) region.

2. Measure physical parameters during collection.

3. Conduct remote mapping efforts (underwater television).

FINAL REPORT:
South Atlantic OCS Living Marine Resources Study (SCMDR, 1981)

AVAILABILITY: Available from NTIS:
Set - PB82160086
Executive Summary - PB82160094
Final Report (Vol. I, South of Cape Fear) - PB82160102
Final Report (Vol. II, North of Cape Fear) - PB82160110
Appendices - PB82160094

SUMMARY:

The study examined nine live bottom areas located between 30°N and 33°N latitude (fig. 19). Three sites were located in each of three depth zones: inner shelf waters (19-27 m), middle shelf waters (28-55 m), and outer shelf waters (55-100 m). The primary objectives were to characterize the invertebrate and nektonic communities associated with each live bottom area and evaluate factors which might influence community structure such as depth, latitude, bottom relief, season (except at North Carolina sites), and petroleum related activities.

Study results indicated the following: invertebrate communities at all study sites were very diverse relative to sand bottom areas, but algae were generally sparse; community composition of demersal fishes collected at the study areas varied with depth and season; and detrimental impacts from offshore drilling operations were dependent on depth, currents, and distance of platforms (or discharge points) from live bottom areas.

OTHER PUBLICATIONS/REPORTS:
See list for Contract No. 14-12-0001-29185

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-18/29185
CT1-18 Mod. 5/29185

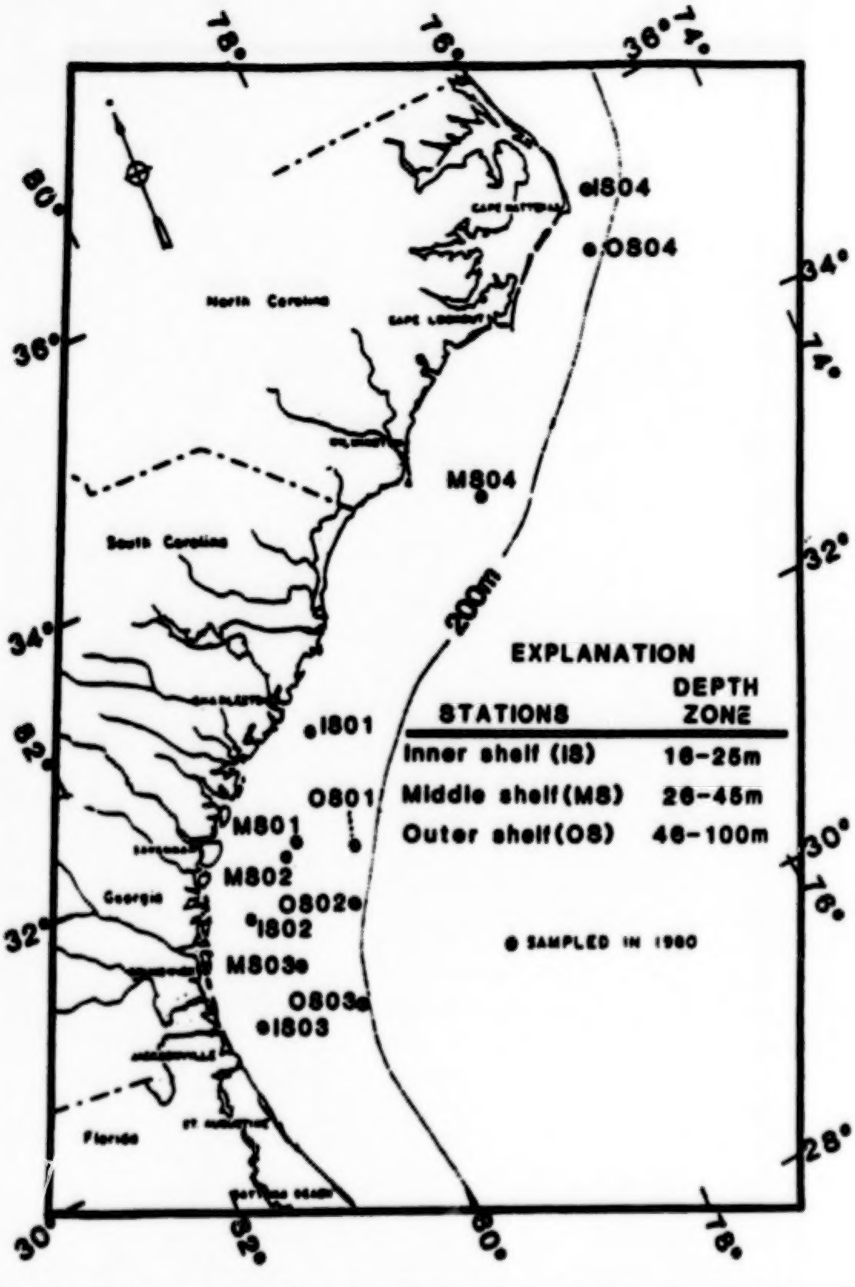

Figure 19. Study areas for the first year of the South Atlantic OCS Living Marine Resources Study, BLM Contract No. AA851-CT9-27.

BLM CONTRACT NO. AA851-CT1-18/MMS CONTRACT NO. 14-12-0001-29185

TITLE: South Atlantic OCS Area Living Marine Resources Study,
Year 2

DATE: 2 February 1981 - Active (see Contract No. 14-12-0001-29185 Mod. 5)

COST: $1,420,379

PRIME CONTRACTOR:

South Carolina Wildlife & Marine Resources Dept. (SCMDR)
P.O. Box 12559
Charleston, South Carolina 29142

SUBCONTRACTORS/COOPERATING INSTITUTIONS:

Georgia Coastal Resources Division (GCRD)
Duke University Marine Laboratory (DUML)

PROGRAM MANAGER:

Project Leader - Victor G. Burrell, Jr.
Project Coordinator - Robert Van Dolah

PRINCIPAL PARTICIPANTS:

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Jeanette H. Phillips (GCRD)
Robert Reimold (GCRD)
Richard Searles (DUML)
George R. Sedberry (SCMDR)
B. W. Stender (GCRD)
Elizabeth L. Wenner (SCMDR)

CONTRACTING OFFICER:

Frances L. Sullivan
Jeffrey P. Petrino

COR: Rosalind Cohen
Alyce T. Fritz

OBJECTIVES:

Primary emphasis during the second-year study is to:

1. Characterize the assemblages of benthic invertebrates and demersal fishes that inhabit representative live-bottom areas in three bathymetric zones.

2. Characterize food habits of selected fish species of commercial or recreational importance.

3. Assess bottom topography and substrate type of the live-bottom areas.

4. Formulate hypotheses on potential impacts of oil and gas related activities.

FINAL REPORT:

South Atlantic OCS Area Living Marine Resources Study Year II (SCMDR, 1982)

AVAILABILITY: Available from NTIS:

Executive Summary	- PB84168285
Final Report (Vol. I, North Carolina)	- PB84168251
Final Report (Vol. II, South Carolina & Georgia)	- PB84168269
Appendices (Vol. III)	- PB84168277

SUMMARY:

Nine areas were sampled quarterly during 1981 to obtain more detailed seasonal data (fig. 20). Three of the sites were located off North Carolina, three off South Carolina, and three off Georgia. This arrangement of stations was selected to provide additional information on the geographic distribution of live-bottom fauna and flora. Bathymetric zonation of communities was evaluated by selecting three sites in each of the three bathymetric zones (16-25 m, 26-45 m, 46-100 m).

Physical characteristics of the live-bottom sites were assessed through underwater-television transects, fathometer transects, and by diver observations at those sites not previously sampled during 1980. These efforts provided information on the areal extent of each site, the proportion of bottom types within each site, and the degree of rock relief. Although these techniques also provided information on the biota present, additional sampling was conducted to assess community structure both quantitatively and qualitatively. Fishes were sampled by day and night trawls, epibenthic sled, hook and line, and baited traps. Large benthic macrofauna and flora were sampled with trawls and a Cerame-Vivas dredge. Smaller invertebrates were sampled with either an airlift-suction sampler operated by divers (inner- and middle-shelf sites) or a Smith-McIntyre grab (outer-shelf sites). Bathymetric profiles of salinity, temperature, and dissolved oxygen were obtained using Niskin bottles, and water-clarity profiles were obtained using a transmissometer.

OTHER PUBLICATIONS/REPORTS:
See list for Contract No. 14-12-0001-29185 Mod. 5.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-18 Mod. 5/29185
CT9-27/29168

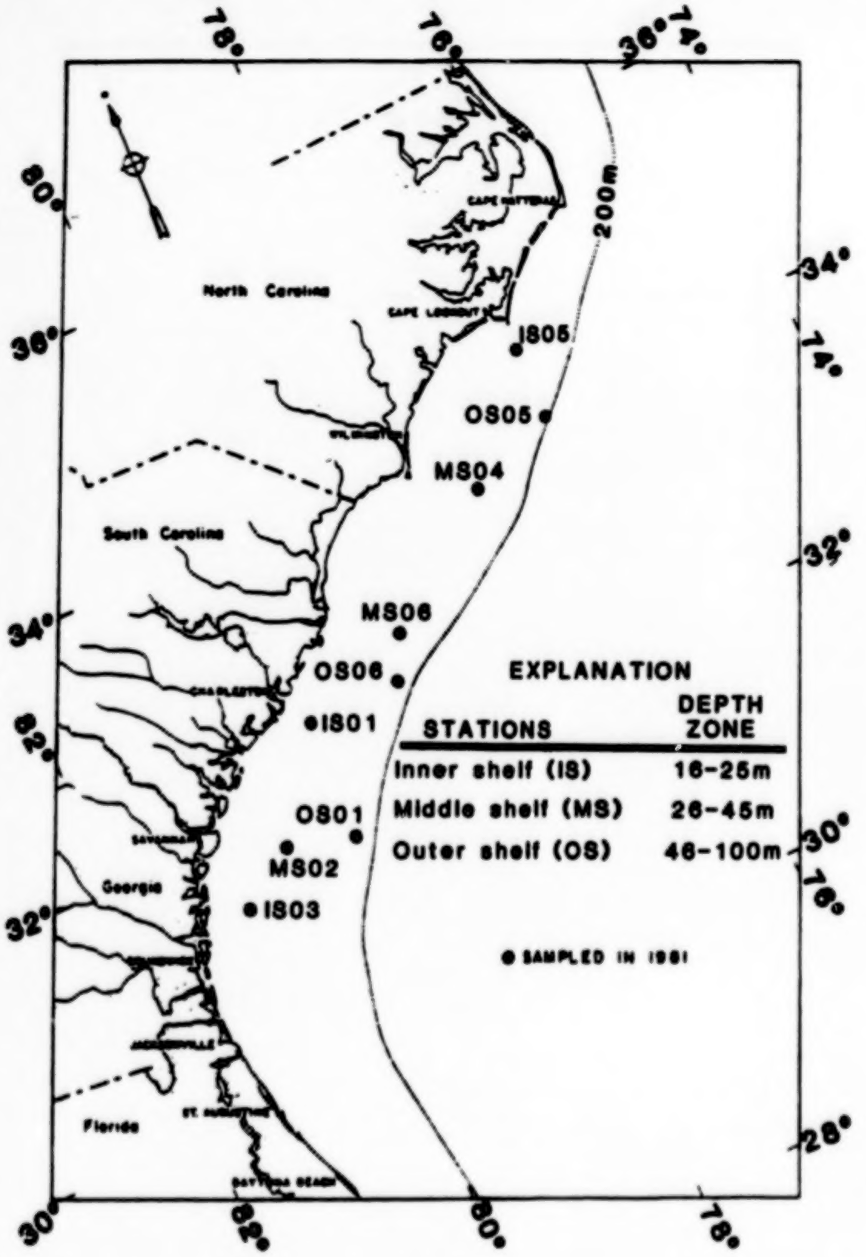

Figure 20. South Atlantic OCS Area Living Marine Resources Study Sites, Year 2.

BLM CONTRACT NO. AA851-CT1-18 MODIFICATION 5/MMS CONTRACT NO. 14-12-0001-29185

TITLE: South Atlantic OCS Area Living Marine Resources Study, Year 3

DATE: 28 September 1982 - Active

COST: $299,931 (Estimated)

PRIME CONTRACTOR:
South Carolina Wildlife & Marine Resources Dept. (SCMDR)
P.O. Box 12559
Charleston, South Carolina, 29142

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Georgia Coastal Resources Division (GCRD)

CHARTERED RESEARCH VESSELS:
R/V Bagby
R/V Lady Lisa
R/V Oregon

PROGRAM MANAGER:
Project Leader - Victor G. Burrell, Jr.
Project Coordinator - Robert Van Dolah

PRINCIPAL PARTICIPANTS:
Priscilla Hinde (SCMDR)
David M. Knott (SCMDR)
H. L. H. Ansley (GCRD)
George R. Sedberry (SCMDR)
James T. Stribling (SCMDR)
Elizabeth L. Wenner (SCMDR)

CONTRACTING OFFICER:
Fred M. Galinsky
Jeffrey P. Petrino

COR: Jeffrey L. Hyland
William H. Lang
Rosalind E. Cohen
Alyce T. Fritz

OBJECTIVES:
The main objectives for each task are as follows:

Task I. Short-term and Long-term Colonization Studies

1. Analyze and compare seasonal recruitment to artificial substrates placed on both a live bottom area and on a sand bottom area distant from neighboring live bottom areas and local sources of recruitment.

2. Assess short-term succession by epibenthic organisms on artificial substrates.

3. Determine how spatial orientation (vertical vs. horizontal) of artificial substrates affects colonization and succession.

4. Assess long-term invertebrate community development patterns on artificial reef structures that are undergoing similar ecological successions but are of different ages.

5. Assess demersal fish assemblages associated with the above artificial structures.

6. Estimate the recovery period for live bottom communities following hypothetical drilling-related perturbations.

TASK II. A study of the Sediment-Depth Limitations of Dominant Live Bottom Fauna

1. Assess the distribution and density of important large live bottom taxa in relation to sediment depth.

2. Determine the sediment-depth limitations of these taxa.

3. Evaluate how changes in sediment depth related to outer continental shelf (OCS) drilling activities might alter the distribution and occurrence of these live bottom fauna.

Task III. Continuation of the Study of Food Habits of Fishes Associated With Live Bottoms

1. Complete the measurement of prey selectivity indices for predator species studies during Phases I and II, based on comparisons of the diets of these species to epifaunal invertebrate species composition and abundance (as determined from suction and grab samples).

2. Determine size and age-related differences in the food habits of important fishes associated with live bottoms.

3. Analyze and compare the food habits of fishes from different bathymetric zones.

4. Determine the food habits of additional dominant and economically valuable fishes collected but not studied during the previous efforts. These additional species include *Haemulon aurolineaturm*, *Archosargus probatocephalus*, *Lagondon rhomboides*, *Diplectrum formosum*, *Equetus lanceolatus*, and *Apogon pseudomaculatus*.

5. Measure diet overlap among all fishes studied.

6. Develop a qualitative model of energy flow through the live bottom ecosystem, based on the trophic information provided by the analysis of food habits for the 13 dominant and priority live-bottom fishes, the data from the analysis of benthic communities, and the information on the dependence of these fishes on the benthic community.

FINAL REPORT:

South Atlantic OCS Area Living Marine Resources Study Phase III - 3 volumes (SCMDR, 1984).

AVAILABILITY:

(Final Report to be submitted to NTIS).

SUMMARY:

This report volume describes three study tasks designed to aid in a better understanding of the possible effects of energy or mineral related activities on hard-bottom communities in the South Atlantic Bight. Task I involved a study of short-term and long-term colonization patterns by invertebrates and fishes on artificial hard substrata. Results from this task documented differences in community development related to season, surface orientation, and proximity to hard-bottom habitat. The study also indicated that recovery of hard-bottom communities from a catastrophic disturbance is likely to take several years. Task II involved a study of the distribution of sponges and corals in relation to sediment depth over hard substrata. Results from this study suggested that some sponge and coral species are very sensitive to increases in sediment cover which may result from industry-related activities. Task III was a study of food habits of hard-bottom fishes. Data obtained from this task indicated that some of the priority species examined depend on hard-bottom areas for food resources. Other fishes are less dependent on these areas for food but are only abundant in hard-bottom reef habitats. Task III results indicated that destruction of biota forming the lower trophic levels of the hard-bottom food web would seriously affect certain commercially and recreationally important fish species.

OTHER PUBLICATION/REPORTS:

Sedberry, G. R. Food and feeding of the tomtate Haemulon aruolineatum (Pisces, Haemulidae) in the South Atlantic Bight. Fish. Bull. (In review). [Describes food habits of tomtate from Year I and Year II studies].

Sedberry, G. R. and T. A. Nimmich. Food habits of some fishes associated with live bottom habitat off the South Atlantic coast of the USA (Accepted in Marine Biology, in revision). [Describes fish stomach data from the Year I and Year II studies].

Sedberry, G. R., and R. F. Van Dolah, 1984. Demersal fish assemblages associated with hard bottom habitat in the South Atlantic Bight of the USA. Environmental Biology of Fishes 11(4):241-258. [Describes nektonic data obtained from the Year I study].

Van Dolah, R. F. et al., Remote assessment of sponge-coral assemblages inhabiting hard bottom areas of the South Atlantic Bight, USA. (In preparation). [Describes television data for large invertebrates obtained from the Year I and Year II studies].

Wenner, E. L. Community composition and structure of decapod crustaceans from hard bottom substrates in the South Atlantic Bight. (In preparation). [Describes decapod data for obtained from the Year I and Year II studies].

Wenner, E. L., D. M. Knott, R. F. Van Dolah, and V. G. Burrell, Jr., 1983. Invertebrate communities associated with live bottom habitats in the South Atlantic Bight. Estuarine, Coastal and Shelf Science 17: 143-158. [Describes invertebrate data obtained during the Year I study].

Wenner, E. L., P. Hinde, D. M. Knott, and R. F. Van Dolah, 1984. A temporal and spatial study of invertebrate communities associated with hard-bottom habitats in the south Atlantic Bight. NOAA Technical Report NMFS 18:104. [Describes invertebrate data from the Year II study].

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT1-18/29185
CT9-27/29168

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MULTIREGIONAL & NATIONAL STUDIES

Environmental Inventories and Assessments

BLM CONTRACT NO. AA851-CT2-47/MMS CONTRACT NO. 14-12-0001-29200

TITLE: An Environmental Summary of the U.S. Atlantic Continental Slope and Rise

DATE: 23 August 1982 - February 1985

COST: $220,823

PRIME CONTRACTOR:

Marine Geoscience Applications (MGA)
Box 656
Woods Hole, Massachusetts 02543

SUBCONTRACTORS/COOPERATING INSTITUTIONS:

Woods Hole Oceanographic Institution (WHOI)

PROGRAM MANAGER:

John D. Milliman

PRINCIPAL PARTICIPANTS:

R. Gagosian	B. Tucholke
T. Joyce	P. Wiebe
D. Ross	Carolyn Winn (WHOI)
W. Schmitz	W. R. Wright

CONTRACTOR OFFICER:

Jeffrey P. Petrino

COR: Eiji Imamura
William H. Lang

OBJECTIVES:

1. Collect and compile environmental data for Continental slope and rise areas from 200 m to maximum depths within the Minerals Management Service (MMS) planning areas extending from the Canadian border south to 28°N. latitude. Data will include published and unpublished information, current research, and impending programs.

2. Synthesize and reduce this information into a useable data base, and identify gaps in environmental information.

3. Prepare a bibliographic listing of all published and unpublished reports.

FINAL REPORT:

Environmental Summary of the U.S. Atlantic Continental Slope and Rise, 28°-42°N (MGA, 1984)

AVAILABILITY: Available from NTIS:
Final Report (Vol. I, Introduction, Meteorology, Physical Oceanography, Geology, Chemistry) - PB-------
Final Report (Vol. II, Biology, Human Activities, Future Studies, Bibliography) - PB-------

SUMMARY:

The Atlantic Continental Slope and Rise (ACSAR) off the eastern United States is defined as lying between latitudes of 28 and 42°N, and between water depths of 200 and 4000 m (fig. 21). This report deals with environmental data and information in this area. It covers six general topics which together deal with the total subject. These topics include Meteorology and Air-Sea Interactions, Physical Oceanography, Geology, Marine Chemistry, Biological Oceanography, and Human Activities and Impacts. The final section of the report discusses the types of future studies which will aid in the understanding of the ASCAR environment.

Meteorology and Air-Sea Interactions

The general circulation pattern is dominated by the "Bermuda High," a high pressure system located in the subtropical gyre of the North Atlantic Ocean. About 85 percent of all tropical cyclones, storms with sustained winds between 34 and 63 knots, occur during August, September, and October. Extratropical storms occur mostly during the fall and winter. Precipitation over the ACSAR reaches a maximum of 1.6 m yr^{-1} over the axis of the Gulf Stream east of Cape Hatteras, dropping to less than 1 m yr^{-1} near the coast. There is a slight bias toward more rainfall in winter. Seasonal cycles of heating and cooling, evaporation, and precipitation affect the temperature, salinity, and related hydrography of the upper layers of the ocean.

Physical Oceanography

The character of the water overlying the Atlantic Continental Slope and Rise changes dramatically at Cape Hatteras, where the Gulf stream diverges from the coast. Southwest of Hatteras the Stream impinges directly upon the slope. Northeast of Hatteras the Stream Meanders offshore and the space between it and the shelf is occupied by slope water. Seasonal variability penetrates only to about 200 m. The ASCAR contains the strongest low frequency currents in the world, among these are the Gulf Stream and the Western Boundary Undercurrent.

Geology

The continental slope extends from the shelf slope break (60 to 200 m) to 2000 m; width varies from 10 to 50 km. The continental rise, which extends from 2000 to 5000 m and greater, is marked by a generally decreasing gradient. The "mud line" occurs at 250-300 m, below which silt and clay-size sediments predominate. On the Blake Plateau, biogenic sands and gravels predominate. The dominant sedimentary process is gravity controlled downslope movement. There are local occurrences of faulting, but only one major surface fault has subsurface expression - the outer edge of the Blake Plateau.

Chemistry

Water column distributions of dissolved nutrients depend upon both water mass and water depth. Surface concentrations are relatively depleted during warm weather months, and elevated in colder periods.

Biology

Bacteria are important and abundant, but understudied. The patchy distribution of phytoplankton in the continental slope and rise waters off the eastern U.S. are largely dictated by water mass properties and season. Zooplankton distributions are strongly affected by Gulf Stream Rings, which create a mosaic of expatriated communities interspersed with endemic communities. The size and abundance of bottom dwelling organisms decreases with increasing water depth, but average weight of fish increases below 500 m.

Human Activities and Impacts

Active commercial fishing in deep water on and over the edge of the continental shelf by U.S. fishermen includes tilefish, billfish, sharks, lobster, and red crab. Commercial fisheries for cod, haddock, silver hake, red hake, scup, sea bass, summer flounder and redfish also exist but are not predominated by U.S. fishermen. Areas in and adjacent to the ACSAR area receive large quantities of waste as a result of ocean dumping. There are two areas of special habitat which might influence development in the ACSAR area: canyon heads and canyons, and deep-water corals.

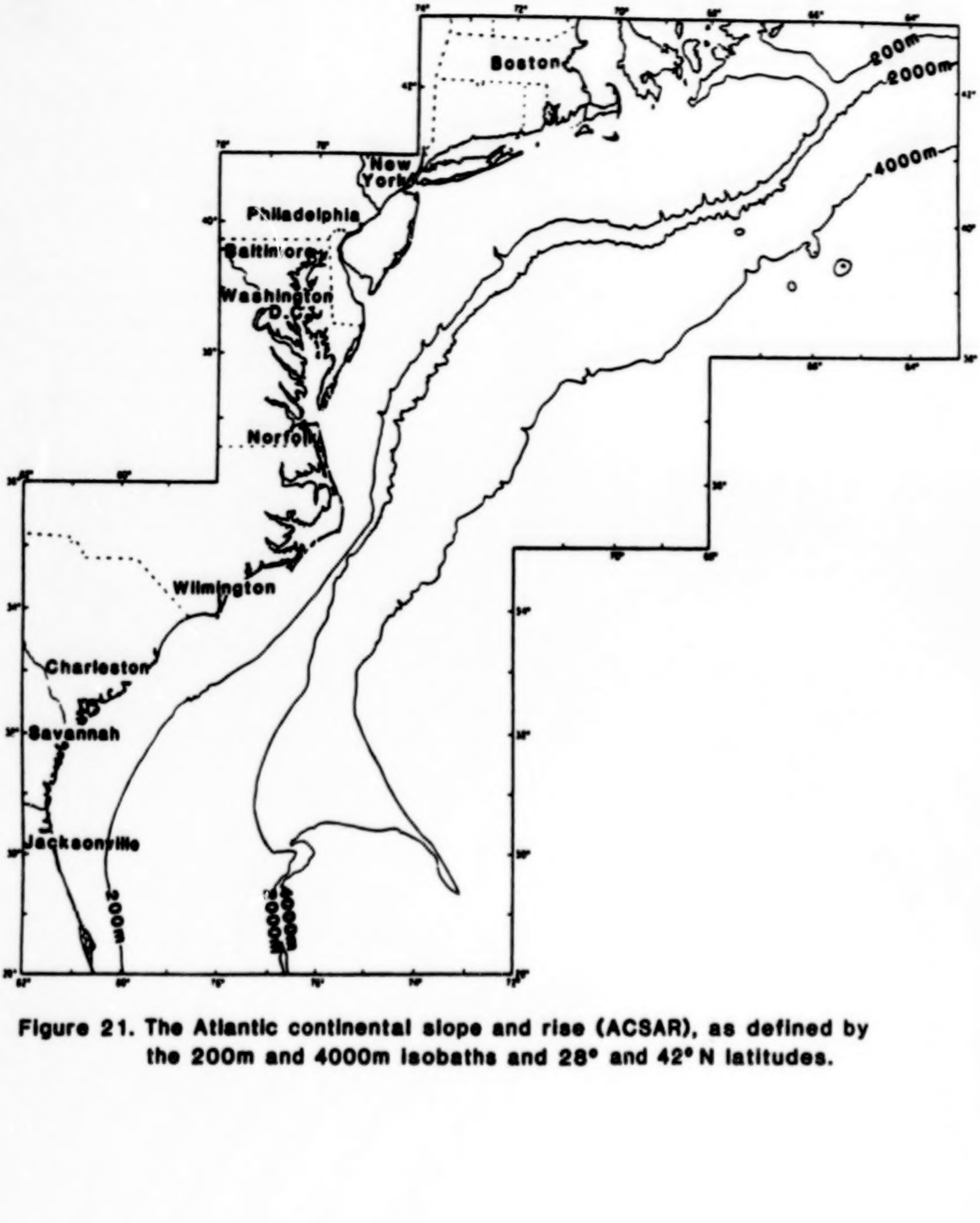

Figure 21. The Atlantic continental slope and rise (ACSAR), as defined by the 200m and 4000m isobaths and 28° and 42° N latitudes.

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MULTIREGIONAL & NATIONAL STUDIES

Socio-Economic Studies

BLM CONTRACT NO. 088550-CT5-51

TITLE: Tourism - Related Economic Data at the County Level

DATE: June 1975 - October 1975

COST: $31,379

PRIME CONTRACTOR:

U.S. Travel Data Center (USTDC)
1100 Connecticut Ave., N.W.
Washington, D.C. 20036

OBJECTIVE:

The objective of this study was to estimate the annual impact of travel activity of U.S. residents on national, state, and county economics in this country.

FINAL REPORT:

Travel Economic Impact Model; Volume I -- Final Economic Analysis Methodology; Volume II, Final Demonstration Report (USTDC, 1975)

AVAILABILITY:

Available from NTIS: Final Report - PB249365

SUMMARY:

The Economic Impact Model was developed to estimate the annual impact of travel activity of U.S. residents on national, state, and county economics. The disaggregated model was built upon estimates of 15 travel expenditure categories, their impact on 13 types of travel-related business at the retail level, and the business receipts, employment, and personal income tax receipts which result. Volume I describes the model including the limitations and methods for updating. Volume II is an application of the model which assesses the impacts of OCS development on "pleasure travel" in 12 Mid-Atlantic coastal counties. "Pleasure travel" was only considered because it is most apt to be altered by oil spills which may adversely affect the coastal environment.

It was clear in this study that as general business conditions decline, business travel is reduced. Moreover, common carrier travel can be expected to decline as well traveler's switching to the automobile as an economy move. However, pleasure travel does not seem susceptible to the depressed state of the economy. Further study of the relationships between the different types of travel and economic conditions is required before definite forecasts can be made of these effects.

BLM CONTRACT NO. AA551-CT9-26/MMS CONTRACT NO. 14-12-0001-29167

TITLE: Assessment of Space and Use Conflicts on the U.S. Outer Continental Shelf Between Oil and Gas Industry and Commercial and Recreational Fisherman

DATE: 26 September 1979 - February 1982

COST: $334,467

PRIME CONTRACTOR:
Centaur Associates, Inc. (CAI)
Suite 465
1120 Connecticut Avenue, N.W.
Washington, DC 20036

SUBCONTRACTOR:
Dames and Moore, Los Angeles (DM)

PROGRAM MANAGER:
Bradley S. Ingram

PRINCIPAL PARTICIPANTS:
Fred J. Proschaska (Consulting Economist)
Martin A. Roessler (TBI)
Durbin C. Tabb (TBI)

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Neville Chow

OBJECTIVES:
One of the major data gaps identified by previous studies and by the Minerals Management Service (MMS) in the assessment process is the degree to which oil and gas activities will conflict with commercial and recreational fishing activities. Specific objectives of this study were to:

1. Determine the probable loss in commercial and sport fishing revenues expected to be caused by withdrawal of fishing grounds to be occupied by structures such as rigs, platforms, subsea completions, pipelines, etc.

2. Determine the probable increase in commercial and sport fishing costs caused by competition for inputs, including labor, boat repair services, fuel, and harbor space.

3. Determine the degree to which the conflicts identified in (1) and (2) above can be mitigated, and cost/benefit analyses of possible mitigating measures.

FINAL REPORT:

Assessment of Space and Use Conflicts between the Fishing and Oil Industries, (Centaur Associates, 1981)

AVAILABILITY:

Available from NTIS:
Set - PB81215956
Final Report (Vol. I, Fishing Gear) - PB81215964
Final Report (Vol. II, Engineering) - PB81215972
Final Report (Vol. III, Historical Interactions) - PB81215980
Final Report (Vol. IV, Modeling) - PB81215998
Final Report (Vol. V, Site Visits) - PB81216004

SUMMARY:

Volume I describes the types of fishing gear currently used and assesses the probable impact that oil and gas structures will have on fishing operations. These structures include both surface and subsurface structures such as platforms, drilling rigs, subsea completions, pipelines, etc. The geographical scope includes the following regions: North Atlantic, Mid-Atlantic, South Atlantic, Gulf of Mexico, and Southern and Northern/Central California.

The basic approach to the fishing gear descriptions was a literature review supplemented by numerous personal contacts. The assessment of potential interactions with oil and gas structures was based in part on the history of such interactions in the Gulf of Mexico, off Southern California, and in the North Sea.

Volume II specifically addresses the engineering aspects of this study. The report describes the existing and proposed offshore oil and gas technologies, the criteria and constraints used for technology selection in outer continental shelf (OCS) areas, and gives specific examples for the following regions: North Atlantic, Mid-Atlantic, South Atlantic, Eastern/Central Gulf of Mexico, Southern California, and Northern/Central California. Finally, mitigating measures and their related costs are discussed and specific examples are taken from experience in the North Sea.

Volume III explores the historical interactions which have taken place between the fishing and oil and gas industries with respect to competition for labor, port space, and other areas of impacts including fuel and repair facilities, equipment, supplies, and financing. This volume includes a detailed examination of effects which have taken place in the North Sea, Southern California, Western Gulf of Mexico, and Davisville, Rhode Island.

Volume IV presents results of a modeling effort to estimate the loss in catch to the commercial fishing industry due to OCS structures located on fishing grounds. The model assumes that fish move randomly in an area around an OCS structure. A Markov-type statistical process is used to model the statistical probabilities of fish moving into and out of a designated buffer zone and the probability of being caught while outside the buffer zone. The relative catch under various OCS development alternatives and with various assumed parameters is compared with the relative catch under no OCS development and analogous parameters. This produces a percentage catch loss which can be applied to the expected quantity and value of catch to estimate the expected loss.

Volume V presents the findings of site visits to 30 ports for the regions listed below and makes projections concerning the impacts of offshore oil and gas development on the fishing industry. The regions included in the analysis are the North Atlantic, Mid-Atlantic, South Atlantic, Gulf of Mexico, Southern California, and Northern/Central California. Emphasis is placed on the needs of the fishing industry as compared to the needs of the oil and gas industry for vessels, labor, space, fuel, marine repair facilities, and other operational requirements. The needs of the offshore oil and fishing industries have been projected over the next 30 years by region and by port.

BLM CONTRACT NO. AA851-CT2-41/MMS CONTRACT NO. 14-12-0001-29199

TITLE: Alternative Modes for Transporting OCS-Produced Oil and Natural Gas

DATE: 5 August 1982 - 3 June 1983

COST: $150,000

PRIME CONTRACTOR:
Policy Planning & Evaluation, Inc. (PPE)
8301 Greensboro Drive, Suite 460
McLean, Virginia 22102

SUBCONTRACTORS/COOPERATING INSTITUTIONS
Prashant D. Agrawal
Allen R. Broyles
Robert N. DiNapoli

PROGRAM MANAGER:
James V. Carboni

PRINCIPAL PARTICIPANTS:
Edward Burrows
James V. Carboni
James D. Dickson
Robert N. DiNapoli
Jasbinder Singh

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Neville Chow

OBJECTIVES:
The objectives of the study were as follows:

1. Identify possible modes of transporting oil and natural gas other than by pipeline, and the onshore and offshore facilities needed for each mode, including those needed for the offshore conversion of natural gas and the offshore storage, treatment, and loading of oil.

2. Determine the technological feasibility, regulatory framework, and environmental constraints of the facilities needed for the identified transport modes.

3. Determine the capital and operating costs of the facilities required for each transport mode, including pipeline, and the unit cost per transport system.

FINAL REPORT:

Alternative Modes for Transporting OCS-Produced Oil and
Natural Gas (J.V. Carboni, E.M. Burrows, J.D. Dickson;
1983)

AVAILABILITY:

Available from NTIS:
Final Report - PB84140284

SUMMARY:

Currently the only methods used for transporting offshore oil are pipelines and tankers. Pipelines are the only proven transportation option for offshore gas. However, water depths in the Atlantic Outer Continental Shelf (OCS) extend to over 4,000 meters (13,000 feet), and these depths are beyond current pipelaying capabilities. In addition, certain areas of the Atlantic experience periods of severe weather, and it is uncertain whether existing transportation technologies can be adapted to accommodate these rough conditions.

The purposes of this study were to examine the technical developments underway to extend the capabilities of existing technologies, and to develop new approaches. For those technologies that were deemed technically feasible, a net present value analysis was conducted to test their viability. In addition to oil and gas pipelines, the study considered: 1) oil transportation by tanker; 2) natural gas conversion to liquefied natural gas; 3) natural gas conversion to methanol; 4) natural gas conversion to ammonia; and 5) electricity generation. The study was based on a detailed literature search and extensive interviews with industry representatives.

According to the analysis, pipelines have a higher net present value (NPV) for all base cases. This result is influenced to a large extent by the base case assumptions for several variables including discount rates and contingency funds. The discount rates assumed for the alternatives are, in all cases, much higher than those required for pipelines. This skewed the results against alternatives in favor of pipelines.

For purposes of this comparison, the distance to shore used for tankers in the base case was decreased to equal the distances used for oil pipelines in the base case. Then, for selected scenarios, the discount rate used for tankers in the base case was lowered to equal the mid-range value for oil pipelines. Looking at the results it is evident that even when the distance to shore (or port) is assumed equal, oil pipelines remain economically more attractive as evidenced by a higher NPV. However, when both distance to shore (or port) and the discount rate are the same for both modes, the advantage of pipelines all but disappears for large and medium size fields and, in fact, tankers are marginally more attractive for the smallest field. This shows the relative impact a change in the discount rate can have on the NPV for a particular mode. However, only oil pipelines are expected to have a discount rate this low, since they will almost assuredly be regulated by the Federal Energy Regulatory Commission.

The effect of discount rates is not as great for the gas transportation alternatives. Both conversion technologies use base-case discount rate of 13 percent, nearly double the 7 percent rate for gas pipelines. However, gas pipelines are significantly more attractive even when the discount rate is increased to 13 percent. Given like discount rates, on average, gas pipelines produce an NPV 79 percent greater than methanol and 38 percent greater than liquid natural gas.

MULTIREGIONAL & NATIONAL STUDIES

Geology/Chemistry

BLM INTERAGENCY AGREEMENT NO. AA551-MU9-04

TITLE:	Studies of the Environmental Geology of the Middle and North Atlantic OCS Region (FY 1979)
DATE:	9 February 1979 - February 1981
COST:	$1,284,140

PRIME CONTRACTOR:

U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTORS/COOPERATING INSTITUTIONS:

Woods Hole Oceanographic Institute (WHOI)

PROGRAM MANAGER:

James M. Robb

PRINCIPAL PARTICIPANTS:

John Aaron	Harley J. Knebel
Robert C. Beardsley (WHOI)	John A. Moody
James S. Booth	Marlene Noble
Michael H. Bothner	Dennis W. O'Leary
Bradford Butman	L. J. Poppe
John C. Hampson, Jr.	David C. Twichell

CONTRACTING OFFICER:

Jeffrey P. Petrino

COR: Eiji Imamura

OBJECTIVES:

The program conducted six cruises between 1 October 1978 to 30 September 1979 to collect data from bottom-moored tripods/current meters, hydrographic transects, piston cores, and high resolution seismic records. Objectives of the program were to:

1. Estimate the extent and rate of sediment mobility over the seabed and monitor resultant changes in bottom morphology and texture.

2. Identify major processes causing sediment movement and assess seasonal variability.

3. Identify and study the effect of processes and mechanisms contributing to sediment instability in offshore lease areas which may lead to inception of slumping and sliding.

4. Identify, age, and map areas of slumping and potential slump hazards in Sale 49 and 52 lease areas, and further offshore in future sale areas.

5. Determine the magnitude and potential geological hazards in Sale 40, 42, 49, and 52 lease areas through historical data review and field surveys.

6. Assess the geotechnical properties of sediments in Sale 40, 42, 49, and 52 lease areas.

7. Support the activities of the physical oceanography contractor by obtaining supplemental physical measurements and helping to synthesize and interpret geological data as it pertains to physical oceanographic shelf processes.

FINAL REPORTS:

Environmental Geologic Studies in the Georges Bank Area United States Northeastern Atlantic Continental Margin, 1978-1979. (MU8-24 and MU9-4) (D. W. O'Leary, 1982)

Environmental Geologic Studies in the Mid-Atlantic Outer Continental Shelf area--Results of 1978-1979 Field Seasons (MU8-21 and MU9-4) (J. M. Robb, 1982)

AVAILABILITY:

Available from NTIS:
(MU8-24 and MU9-4) Final Report - PB83144808
(MU8-21 and MU9-4) Final Report - PB83147934

SUMMARY: See contracts MU8-24 and MU8-21 for summaries.

OTHER PUBLICATIONS/REPORTS:

Booth, J.S. 1981. Geotechnical properties. In Data File: Atlantic Margin Coring Project (AMCOR) of the U.S. Geological Survey, ed. by L.J. Poppe. U.S. Geological Survey Open-File Report 81-239, p. 52-64.

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Booth, J.S., R.A. Farrow, and T.L. Rice. 1981. Geotechnical studies and slope stability analysis of surficial sediments on the Baltimore Canyon Continental Slope. U.S. Geological Survey Open-File Report 81-733, 255p.

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In Geotechnology in Massachusetts, Graudate School, ed. by O.C. Farquhar. University of Massachusetts, Amherst, p. 567-604.

Booth, J.S., J.M. Robb, J.A. Aaron, and R.A. Farrow. 1981. Past and potential mass movement on the Continental Slope off the northeastern United States. American Association of Petroleum Geologists 65(5):904.

Bothner, M.H., C.M. Parmenter, R.R. Rendigs, B. Butman, L.J. Poppe, and J.D. Milliman. 1982. Studies of suspended matter along the North and Middle Atlantic Outer Continental Shelf. U.S. Geological Survey Open-File Report 82-938, 41 p.

Butman, B. 1980. Dynamics of the surface sediments along the U.S. East Coast (abs.). International Geological Congress, Paris, July 1980, Proceedings.

Farrow, R.A. and J.S. Booth. 1980. Preliminary results of geotechnical tests on surficial sediments in the Georges Bank and Baltimore Canyon lease areas (abs.). Conference on Geotechnology in Massachusetts, University of Massachusetts, Boston, March 1980. Program with Abstract.

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Hathaway, J.C., J.S. Booth, and H.W. Olsen. 1980. Mass-movement hazards on the United States Atlantic Continental Slope: problems and approaches (abs.). Geological Society of America, Abstracts with Programs, v. 12, no. 7.

Houghton, R.W., R. Schlitz, R.C. Beardsley, B. Butman, and J.L. Chamberlin. 1982. The Middle Atlantic Bight cold pool; evolution of the temperature structure during the summer 1979. Journal of Physical Oceanography 12:1019-1029.

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Olsen, H.W., J.S. Booth, J.M. Robb, W.S. Gardner, R.D. Singh, P.G. Swanson, P.W. Mayne, and R.G. Hamadock. 1981. Geotechnical laboratory test results on piston core samples taken from the Mid-Atlantic upper Continental Slope by the U.S. Geological Survey during September 1979. U.S. Geological Survey Open-File Report 81-366, 746 p.

Robb, J.M. 198x. Geomorphology, processes, and hazards of the Mid-Atlantic Continental Slope. In Conference on continental margin mass wasting and Pleistocene sea-level changes, ed. by D.W. Folger and J.C. Hathaway. U.S. Geological Survey Circular (in press).

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MU0-16/29175
MU0-18/29175
IA1-15/29183
IA1-17/29184
IA2-26/29196
MU6-29
MU6-56
MU8-13
MU8-21
MU8-24
CT5-42 & MU5-33
CT6-62 & MU7-31
MU9-04
MU9-08/29166

BLM INTERAGENCY AGREEMENT NO. AA851-MUO-18/MMS INTERAGENCY AGREEMENT NO. 14-12-0001-29175

TITLE: Studies of the Environmental Geology of the Middle and North Atlantic OCS Region (FY 1980)

DATE: 12 June 1980 - 31 August 1983

COST: $3,351,365

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTOR/COOPERATING INSTITUTIONS:
Woods Hole Oceanographic Institution (WHOI)

PRINCIPAL PARTICIPANTS:
John Aaron
James Booth
Michael Bothner
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Dennis O'Leary
Charles McClennen
Robert Miller
James Robb
Kathryn Scanlon
David Twichell

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Eiji Imamura

OBJECTIVES:
USGS conducted a research program using 1) the deployment of bottom-moored tripods and current meters to obtain long-term measurements of pressure, current velocity, temperature, turbidity, and small-scale morphologic changes (time-lapsed photographs of the bottom); 2) high resolution seismic records (in closely spaced lines in selected inter-canyon areas) to identify and map areas of slumping or potential slump hazards and for purposes of defining shallow sub-bottom stratigraphy and structures; and 3) piston cores to be analyzed for geotechnical properties for integration with seismic reflection data. Finally, the USGS selectively examined and interpreted previously collected high resolution seismic records (USGS in Conservation Division). Seven cruises were planned from 1 October 1979 to 31 October 1980. Objectives were a continuation of MU9-4 tasks (1-6) in addition to new objectives which were as follows:

1. Obtain field measurements of currents, temperature, salinity, suspended sediment, and bottom processes in canyons, the continental slope, and on the adjacent shelf; document shelf-slope-canyon exchange processes, and characterize the currents (Lydonia--8 tripods, 11 current meter moorings).

2. Define the shallow sub-bottom stratigraphy and identify potential

geological hazards for the nearshore environment in the Mid-Atlantic.

FINAL REPORTS:

Data from this contract have been interpreted and synthesized in the final report of Contract No. IA2-26.

OTHER PUBLICATIONS/REPORTS:

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MU0-16/29175
IA1-15/29183
IA1-17/29184
IA2-26/29196
CT5-42 & MU5-33
CT6-62 & MU7-31
MU6-29
MU6-56
MU8-13
MU8-21
MU8-24
MU9-04
MU9-08/29166

BLM INTERAGENCY AGREEMENT NO. AA851-IA1-17/MMS INTERAGENCY AGREEMENT NO. 14-12-0001-29184

TITLE: Studies of the Environmental Geology of the Middle and North Atlantic OCS Region (FY 1981)

DATE: June 1981 - September 1982

COST: $1,252,249

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTOR/COOPERATING INSTITUTIONS:
Woods Hole Oceanographic Institution (WHOI)

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CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Eiji Imamura

OBJECTIVES:
The contractor conducted nine cruises from 1 October 1980 through 31 January 1982 collect data for the following program objectives:

1. Characterize currents in Lydonia Canyon.
2. Document shelf-canyon, shelf-slope, and slope-canyon bottom and current processes by obtaining field measurements of currents, temperature, density, and suspended sediments.
3. Establish a long-term monitoring program for currents in Lydonia and Oceanographer Canyons such that the seasonal variability and differences in canyon processes can be described.
4. Describe and map the morphology of the heads of Lydonia and Oceanographer Canyon and their adjacent shelf and slope, and identify the processes responsible for shaping them such that pollutant transport into the Canyons can be evaluated.
5. Describe the transport mechanisms, processes, and sediment properties that influence sediment and pollutant movement into and through submarine canyons.

6. Characterize texturally sediments from the axis and walls of Lydonia Canyon and determine the distribution of heavy metals and petroleum hydrocarbons. Trends that indicate the sources of modern sediment to the canyon environment shall also be characterized.

7. Determine the rate and direction of sand wave movement and define areas of sand erosion and accumulation for Georges Bank.

8. Identify and map areas of mass sediment movement on the continental slope and in canyon areas and relate movements to erosional processes within submarine canyon systems.

9. Estimate the extent and rate of bottom sediment movement and identify the major processes causing sediment movement with respect to the seasonal variability and dynamics of currents. The synthesis and interpretation shall emphasize the implications of the observations for movements of materials associated with pollutant transport of materials associated with offshore activity.

FINAL REPORT:

Data from this contract have been interpreted and synthesized in the final report of Contract No. IA2-26.

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OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

MU0-16/29175
MU0-18/29175
IA1-15/29183
IA2-26/29196
CT5-42 & MU5-33
CT6-62 & MU7-31
MU6-29
MU6-56
MU8-13
MU8-21
MU8-24
MU9-04
MU9-08/29166

BLM CONTRACT NO. AA851-IA2-26/MMS INTERAGENCY AGREEMENT NO. 14-12-0001-29196

TITLE: Atlantic Geological Studies FY '82/'83

DATE: 20 August 1982 - August 1983

COST: $1,250,779

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

SUBCONTRACTOR/COOPERATING INSTITUTIONS:
University of Georgia (UG)
University of South Florida (USF)

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Vernon J. Henry (UG)
J. A. Kellman (UG)
John R. Kirby
D. N. Lambert
Charles E. McClennen
Bonnie E. McGregor
John A. Moody
Marlene A. Noble
Paul Pinet
Peter Popanoe
William B. F. Ryan
William L. Stubblefield
David C. Twichell

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Eiji Imamura

OBJECTIVES:
This Interagency Agreement (IA) is the final agreement with USGS for Atlantic geologic studies and serves to allow for completion of all tasks initiated under previous IA's. General task objectives were to:

1. Characterize currents in Lydonia Canyon.

2. Document shelf-canyon, shelf-slope, and slope-canyon bottom and current processes by obtaining field measurements of currents, temperature, density, and suspended sediments.

3. Establish a long-term monitoring program for currents in Lydonia Canyon such that the seasonal variability can be described (FY '84 program suspended).

4. Characterize the currents and bottom transport processes on the continental slope and rise.

5. Map the morphology and shallow structures of the heads of Lydonia and Oceanographer Canyons.

6. Describe the transport mechanisms, processes, and sediment properties that influence sediment and pollutant movement into and through submarine canyons and to evaluate the role of the rise as a sink for pollutants and materials transported seaward within canyon systems.

7. Characterize texturally sediments from the axis and walls of Baltimore Canyon and determine the distribution of heavy metals and petroleum hydrocarbons.

8. Complete synthesis effort on sand wave movement for Georges Bank and the implications to outer continental shelf (OCS) structures.

9. Complete synthesis on the extent and rate of bottom sediment movement with respect to seasonal variability and dynamics of currents.

10. Complete mapping of shallow subcrop geology and shallow seismic stratigraphy of the North Carolina Continental Shelf, slope, and rise in order to identify the processes responsible for shaping the continental margin and to reconstruct its tectonic and depositional history.

FINAL REPORT:

Environmental Geologic Studies on the United States Mid- and North Atlantic Outer Continental Shelf Area (USGS) (B. A. McGregor, editor, 1983)

AVAILABILITY:

Available from NTIS:

Executive Summary (Vol. I)	- PB84187939
Final Report (Vol. II)	- PB84187947
Final Report (Vol. III)	- PB84187954

SUMMARY:

Advances in technology have provided resolution of the sea floor at a scale sufficient to begin to interpret sea-floor processes. The morphology of the submarine canyons and the dendritic pattern of gullies which dissect the slope support the concept that canyons are important transport pathways on the continental margin. Canyons are also important features in building and shaping the continental rise. Differences in channel morphology and sediment distribution of nearby canyons suggest the sea-floor processes can be variable over short distances.

Evidence of erosion on the continental slope and rise is documented by seismic-reflection profile records, mid-range sidescan sonographs, and observation from DSR ALVIN of outcrops on the sea floor. Stability analysis and geotechnical properties of 8-m long piston cores indicate that in general the surficial sediments are stable, however, local conditions may vary and affect this state of stability. Small slumps were identified on the sidescan sonographs and seismic-reflection profiles. Talus blocks and deformed sediments observed on the rise from DSRV ALVIN also are evidence that mass wasting has occurred.

Ocean currents are important agents in eroding and transporting sediment in the shallow water of the continental shelf, resulting in the contraction and migration of bed forms. In the deeper water of the continental slope, ocean currents facilitate transport of sediment into and through the submarine canyons. Bed forms and sediment grain size on the canyon floors also reflect the transport activity of currents in the canyons. Long-term measurements are important in monitoring these currents to determine their variability as well as to identify their forcing mechanisms.

FINAL REPORT:

Ocean Bottom Survey of the U.S. South Atlantic OCS Region
(Marine Geology Program, Univ. of Georgia, 1983).

AVAILABILITY:

Available from NTIS:
Final Report + Appendix I - Cruise Report Summary (Vol. I) - PB ___________
Appendix III, Suppl. Report A (Vol. II) - PB ___________
Appendix III, Suppl. Report B (Vol. III) - PB ___________
Appendix III, Suppl. Report C (Vol. IV) - PB ___________
Appendix III, Suppl. Report D (Vol. V) - PB ___________
Appendix IV, Data Map, Cruise Tracklines - Copy at Atlantic Region Office
Appendix V, Atlas Series (1:250,000 Sheet maps of Brunswick, Jacksonville for Neogene Geology, Trace Metals, Geohazards, and Reefs and Hardgrounds - 8 maps) - Copy at Atlantic Office.

SUMMARY:

In summary the variety of bottom and shallow subbottom conditions encountered during this survey will cause engineering constraints to rig and pipeline route siting, particularly with regard to foundation considerations (See fig. 22 for survey area). However, proper site-analysis and operating procedures should mitigate both engineering and environmental risks. Large faults with shallow expression, areas of sinkholes, large scour features, and large sandwave fields should be avoided.

Productive live bottoms can and should be avoided. None were observed that were so widespread or continuous they could not be accommodated by offsets and easements during both constructional and operational phases. A significant question still unanswered is the legal and scientific definition of "productive" live bottom.

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McGregor, B.A. 1984. The role of submarine canyons in U.S. Atlantic continental slope and upper continental rise development (abs.). American Association of Petroleum Geologists Bulletin 68:505.

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Twichell, D.C., C.B. Grimes, R.S. Jones, and K.W. Able. 198x. The role of erosion by fish in shaping topography around Hudson Submarine Canyon. Journal of Sedimentary Petrology (in press).

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

MU0-16/29175
MU0-18/29175
IA1-15/29183
IA1-17/29184
CT5-42 & MU5-33
CT6-62 & MU7-31
MU6-29
MU6-56
MU8-13
MU8-21
MU8-24
MU9-04
MU9-08/29166

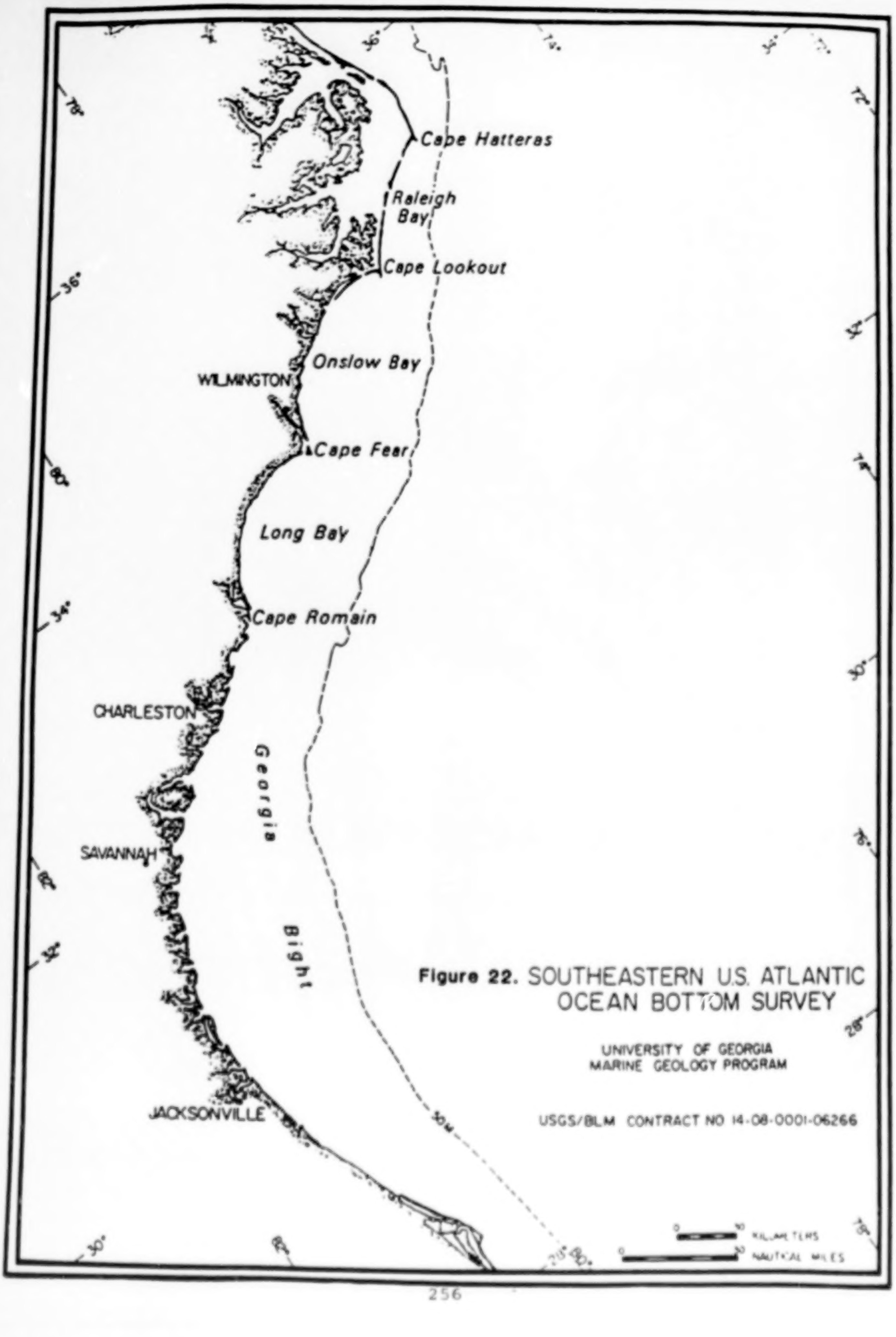

Figure 22. SOUTHEASTERN U.S. ATLANTIC OCEAN BOTTOM SURVEY

UNIVERSITY OF GEORGIA
MARINE GEOLOGY PROGRAM

USGS/BLM CONTRACT NO 14-08-0001-06266

MULTIREGIONAL & NATIONAL STUDIES

Biology

BLM CONTRACT NO. AA551-CT8-49/MMS CONTRACT NO. 14-12-0001-29164

TITLE: Canyon Assessment Study in the Mid- and North Atlantic Areas of the U.S. Outer Continental Shelf

DATE: 28 September 1978 - 1 September 1980

COST: $612,180

PRIME CONTRACTOR:

Lamont-Doherty Geological Observatory
of Columbia University
Palisades, New York 10964

CHARTERED RESEARCH VESSELS:

RV/Eastward

PROGRAM MANAGER:

Michael Rawson

PRINCIPAL PARTICIPANTS:

Gretchen L. Blechschmidt
Robert W. Embley
Patricia Gibson
Barbara Hecker
Dennis M. Opreslo
William B. Ryan
Lawrence G. Sullivan
Peter R. Thompson

CONTRACTING OFFICER:

Jeffrey P. Petrino

COR: J. Philip Thomas
Jeffrey L. Hyland

OBJECTIVES:

The objective of the study was to provide information on the distribution and abundance of coral assemblages and epibenthic communities (such as lobsters, crabs, and shrimps) within canyons in the Mid- and North Atlantic.

FINAL REPORT:

Canyon Assessment Study: Epifaunal Zonation and Community Structure in three Mid- and North Atlantic Canyons (B. Hecker, G. Blechschmidt, P. Gibson; 1980)

AVAILABILITY:

Available from NTIS:
Final Report/Appendices - PB8115589

SUMMARY:

The abundance and distribution of the epibenthic and coral fauna of three major canyons were studied using "Cheep Tow," a towed underwater camera sled. The three canyons surveyed were Baltimore, Lydonia, and Oceanographer Canyons. The surveys focussed on depths between 200 to 1000 meters. Baltimore Canyon most closely resembled slope habitats. It had a high sedimentation rate and limited substrate variability in terms of extent of exposed outcrop, talus, and glacial erratics. Lydonia and Oceanographer Canyons had much greater exposures of different substrate types such as outcrops of rock and consolidated clay, talus, numerous glacial erratics and areas of extensive coral debris.

The shallow-water fauna in the upper parts of the canyons were similar to that found on the slope. These fauna were composed of a variety of species that appeared to have somewhat discrete depth ranges. In general, their distribution was patchy. The deeper water community analysis did not identify any cohesive faunal assemblages. Rather, the results indicated that the dominant fauna was not as variable, except in areas that had exposed hard substrate. The fauna was usually dominated by three species, the crab *Geryon quinquedens* and two demersal fish, *Synaphobranchus kaupi* and rattails. In areas of exposed hard substrate, shrimp, sponges, and coral frequently dominated. The depth ranges of the deeper-water fauna were usually quite broad. The higher concentrations of sessile filter-feeders in the northern canyons attest to the greater variety, and taxa found in canyon habitats were independently distributed, with overlapping ranges in some areas and not in others. The most obvious factor controlling the occurrence of many of the species was availability of suitable substrate. The other factors controlling their distribution are not known. Most areas within the canyons were dominated by one species rather than a group of them. This again attests to the patchiness of the faunal distributions.

Corals, both alcyonarians and scleractinians, were seen in all three canyons. The coral population of Baltimore Canyon tends to be less dense and diverse than it was in the other two canyons. The dominant coral in Baltimore Canyon was a small white sea pen that occurred on soft sediment between 100 to 300 meters depth. Both Lydonia and Oceanographer Canyons had high concentrations of a variety of corals. The three dominant species in these canyons, *Eunephthya florida* in Lydonia Canyon, and *Paramuricea gandis* and *Acanthogorgia aramata* in Oceanographer Canyon, were all restricted to hard substrate. Discrete assemblages of corals were not identified. The distribution of each species appears to be controlled by slightly different habitat requirements.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CTO-59/29178

BLM CONTRACT NO. AA851-CT0-59/MMS CONTRACT NO. 14-12-0001-29178

TITLE: Study of Physical and Biological Processes of Canyons and the Continental Slope in the North and Mid-Atlantic U.S. Outer Continental Shelf.

DATE: 20 August 1980 - Active

COST: $4,651,777

PRIME CONTRACTOR:
Lamont-Doherty Geological Observatory (LDGO)
of Columbia University
Palisades, New York 10964

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Brookhaven National Laboratory (BNL)

CHARTERED RESEARCH VESSELS:
DSRV *Alvin/Lulu*
RV/*Gyre*
RV/*Endeaver*
RV/*Eastward*
RV/*Johnson* & *Johnson-Sea-Link*
RV/*Cape Henlopen*
RV/*Oceanus*

PROGRAM MANAGER:
Dr. Barbara Hecker

PRINCIPAL PARTICIPANTS:
Wilford D. Gardner
Barbara Hecker
Kenneth L. Hunkins
Jeanne C. Stepien

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Rosalind Cohen
Alyce T. Fritz

OBJECTIVES:
The purpose of this study is to examine the oceanographic processes of the Lydonia and Baltimore Canyons and nearby slopes to determine what their role might be in transmitting drilling pollutants to animal life on the ocean bottom. The shelf, canyons, slopes, and the animals that inhabit them are thought to be inextricably linked in dynamic processes that are not well known at present. The objectives of this study are to:

1. Describe and characterize the currents and hydrography within submarine canyons and on the adjacent slopes, and epifauna in selected canyon and slope areas.

2. Describe the exchange of sediments and nutrients between the canyons and the adjacent shelf and the adjacent slope.

3. Determine the abiotic and biotic processes affecting the distribution and abundance of epifaunal communities.

4. Document the along-slope structure of the currents, and the canyon influence on the slope currents.

5. Identify unique and fragile communities which may be affected by oil and gas operations.

6. Identify measures for alleviating or eliminating the effects of oil and gas operations on the epifaunal communities.

FINAL REPORT:

Canyon and Slope Processes Study (LDGO, 1983)

AVAILABILITY:

Available from NTIS:
Executive Summary (Vol. I) - PB84169481
Final Report (Vol. II, Physical Processes) - PB84169499
Final Report (Vol. III, Biological Processes) - PB84169507

SUMMARY:

Dominant physical and biological processes operating in submarine canyon and slope areas of the eastern U.S. continental margin were examined to determine how the effects of outer continental shelf (OCS) activities might be transmitted to benthic communities. Five areas were examined in detail: Baltimore Canyon and the slopes between Lindenkohl and Certeret Canyons, and between Toms and Meys Canyons in the Mid-Atlantic, and Lydonia Canyon and the slope between Hydrographer and Veatch Canyons in the North Atlantic. Study depths ranged from 100 to 2,000 meters. Physical parameters that were examined included mean current flows, suspended sediment transport, nutrient transport, nutrient concentrations, and hydrography (Mid-Atlantic only). Biological parameters included surface and near-bottom zooplankton (Mid-Atlantic only) and megafaunal populations (North and Mid-Atlantic). Results indicated that the physical regime of submarine canyons may well concentrate and transport pollutants through areas that are populated by "unique and fragile" biological assemblages. Some measures for eliminating or alleviating deleterious impacts of OCS development were identified.

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:

CT8-49/29164

BLM CONTRACT NO. AA551-CT9-05/MMS CONTRACT NO. 14-12-0001-29165

TITLE: Study of Crude Oil Effects on Developmental Stages of the American Lobster

DATE: 29 March 1979 - 9 September 1982

COST: $119,848

PRIME CONTRACTOR:
Woods Hole Oceanographic Institution (WHOI)
Woods Hole, Massachusetts 02543

PROGRAM MANAGER:
Judy Capuzzo

PRINCIPAL PARTICIPANTS:
John H. Ryther

CONTRACTING OFFICER:
Fred M. Galinsky

COR: Eiji Imamura;
William H. Lang

OBJECTIVES:
This work is a continuation of an effort begun by the Westinghouse Electric Corporation under Contract No. AA550-CT7-24 and shall not repeat work completed by Westinghouse. Basic objectives were to:

1. Study the effects of exposure of the developmental stages of the American lobster to South Louisiana crude oil.
2. Test the effects of ingestion of oil contaminated food (*Artemia salinia*) on larval growth and development. Parameters investigated were: feeding rates and behavior, growth rates, molt durations, respiration rates, ammonia excretion rates, and O:N ratio.
3. Determine sublethal effects on juvenile lobsters exposed to contaminated sediments.
4. Study body burden and depuration of oil in larval lobsters.
5. Complete histological studies initiated by Westinghouse.
6. Study lipid utilization and storage in oil-exposed larvae.

FINAL REPORT:

Crude Oil Effects on Developmental Stages of the American Lobster, 92 pgs. + Appendix (Westinghouse Ocean Research Laboratory, 1978. Crude Oil Effects to Developmental Stages of American Lobsters. Final Summarization, 27 p.) (J. M. Capuzzo, 1982)

AVAILABILITY:

Available from NTIS: Final Report - PB2117656

SUMMARY:

The physiological effects of South Louisiana crude oil on larvae and juveniles of the American lobster, Homarus americanus, have been investigated in continuous flow bioassay systems. Disruption in the energetics of larval development has been observed and correlated with a shift in the normal patterns of lipid synthesis, utilization, and mobilization in larval lobsters. Hydrocarbon turnover appears to be rapid and little accumulation is observed. Recovery of larval and early postlarval stages is not immediate upon transfer to uncontaminated seawater,and the normal pattern of energy storage and utilization is only restored slowly.

Postlarval lobsters are less sensitive to crude oil-seawater mixtures than the larval stages and no disruption in energetics has been observed. Reductions in respiratory activity and bioaccumulation of both aliphatic and aromatic compounds, however, have been observed in postlarval lobsters exposed to oil contaminated sediments. This suggests that postlarval lobsters have longer retention times and lower turnover rates of petroleum hydrocarbons than the larval stages, and persistence of petroleum hydrocarbons in sediments may present a chronic contamination problem to benthic stages of the American lobster.

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MULTIREGIONAL & NATIONAL STUDIES

Drill Site Monitoring

MMS CONTRACT NO. 14-12-0001-30064

TITLE: U.S. Atlantic Continental Slope and Rise--Biological Process Studies--Part A: Biological Processes on the U.S. North and Mid-Atlantic Slope and Rise--Part B: Biological Processes on the U.S. South Atlantic Slope and Rise

DATE:
30 September 1983 - April 1987 (Part A)
30 September 1983 - April 1987 (Part B)

COST:
$4,853,938 - $5,075,597 (Part A)* *Estimated Ranges
$3,666,045 - $3,866,287 (Part B)*

PRIME CONTRACTOR:
Battelle New England Marine Research Laboratory (BNEMRL)
397 Washington Street
Duxbury, Massachusetts 02332

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Woods Hole Oceanographic Institution (WHOI)
Lamont-Doherty Geological Observatory (LDGO)

CHARTERED RESEARCH VESSELS:
R/V *Gyre* (Part A)
R/V *Oceanus* (Part A)
R/V *Cape Hatteras* (Part A)
R/V *Columbus Iselin* (Part B)

PROGRAM MANAGER:
Nancy Maciolek-Blake (Part A)
James Blake (Part B)

PRINCIPAL PARTICIPANTS:
Part A: Fred Grassle (WHOI)
Paul Boehm (BNEMRL)
Barbara Hecker (LDGO)
Nancy Maciolek-Blake
Part B: James Blake (BNEMRL)
Paul Boehm (BNEMRL)
Fred Grassle (WHOI)
Barbara Hecker (LDGO)

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR:
Jeffrey L. Hyland
Rosalind E. Cohen
Alyce T. Fritz

OBJECTIVES:
The program objectives are to:

1. Characterize pre-drilling biological, geological, and chemical properties of benthic environments at a limited number of stations in the general vicinity of an exploratory drilling rig in each of the three study areas - North Atlantic (NA), South Atlantic (SA), Mid-Atlantic (MA).

2. Monitor potential changes in these properties with time, and determine whether the changes are caused by drilling-related activities or whether they are the result of other phenomena including natural temporal or spatial variation.

3. Determine the distribution and fate of discharged drilling-related materials that have accumulated above background levels.

4. Estimate recovery rates of deep-sea benthic communities potentially impacted by drilling-related activities.

North and South (Phase II) Atlantic:

1. To characterize biological, geological, and chemical properties of benthic environments at a limited number of stations within areas of potential oil and gas development on the Atlantic Continental Slope and Rise.

2. To monitor potential changes in those properties with time to determine the extent of natural temporal and spatial variation.

3. To estimate recovery rates of deep-sea communities potentially affected by drilling-related activities (North only).

Note: The South Atlantic program (Part B) also includes a benthic baseline characterization study (Phase 1 of SA program) which focusses on the following objectives: 1) to characterize biological and surficial geological properties of benthic environments at a limited number of slope/rise sites within areas of potential oil and gas drilling activities in the SA; 2) to provide information on seasonal and spatial variation of communities observed at slope and rise locations in the SA; and 3) to provide a limited regional data base to facilitate evaluation of Phase 2 (SA rig-monitoring study) results.

FINAL REPORT:

AVAILABILITY:

SUMMARY:

MMS INTERAGENCY AGREEMENT NO. 14-12-0001-30197

TITLE: Analysis of Trace Metals in Bottom Sediments in Support of Deep Water Biological Processes Studies on the U.S. Atlantic Continental Slope and Rise

DATE: July, 1984 - July 1987

COST: $372,385

PRIME CONTRACTOR:
U.S. Geological Survey (USGS)
Woods Hole, Massachusetts 02543

CHARTERED RESEARCH VESSELS:
(see Contract No. 30064)

PROGRAM MANAGER:
Michael Bothner

PRINCIPAL PARTICIPANTS:
Michael Bothner

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Rosalind E. Cohen
Alyce T. Fritz

OBJECTIVES:

The program incorporates a multidisciplinary research approach. Overall program objectives will be accomplished by combining the expertise of several independent research teams. Overall objectives are as follows:

1. Characterize predrilling biological, geological, and chemical properties of benthic environments at a limited number of stations in the general vicinity of an exploratory drilling rig in each of the three study areas.
2. Monitor potential changes in these properties with time and determine whether the changes are caused by drilling-related activities or whether they are the result of other phenomena including natural temporal or spatial variation.
3. Determine the distribution and fate of discharged drilling-related materials that have accumulated above background levels.
4. Estimate recovery rates of deep-sea benthic communities potentially impacted by drilling-related activities.

FINAL REPORT:

AVAILABILITY:

SUMMARY:

OTHER RELATED CONTRACTS WITHIN THIS STUDY PROGRAM:
14-12-0001-30064 (Parts A and B)

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MULTIREGIONAL & NATIONAL STUDIES

Oil Spill Studies

BLM CONTRACT NO. 08550-CT5-12

TITLE: TAMANO Oil Spill Study

DATE: 1 July 1974 - 21 September 1977

COST: $28,000

PRIME CONTRACTOR:
State of Maine
Department of Marine Resources (MDMR)
State House
Augusta, Maine 04330

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Bowdoin College (BC)
Bigelow Laboratory (BL)

PROGRAM MANAGER:
Spencer Apollonio (Commissioner MDMR)

PRINCIPAL PARTICIPANTS:
E. Gilfillan (BL)
D. W. Mayo (BC)
D. S. Page (BC)

CONTRACTING OFFICER:
Vernon F. Ehlerding
Jeffrey P. Petrino

COR: Edward Tennyson
Eiji Immaura

OBJECTIVES:

The objectives of this study were to:

1. Estimate the amount of damage done by TAMANO oil to the soft shell clam industry of Casco Bay.
2. Estimate the rate at which recovery from the TAMANO oiling has proceeded.

FINAL REPORT:
Effects of the TAMANO Spill on the Marine Environment (D. W. Mayo, D. S. Page; 1975)

AVAILABILITY:
A review copy is available from the Minerals Management Service, Vienna, Virginia.

SUMMARY:

The report describes the effects of the TAMANO oil spill in Casco Bay, Maine on the soft shell clam (*Mya arenaria*). A comparison between oil-affected clams and organisms from a clean site showed a 50 percent decrease in growth of the affected clams. Carbon flux measurements further indicated that the methods employed in the study are sensitive measures of stress exhibited by *Mya arenaria* to low levels of hydrocarbon contamination. When dealing with low concentrations of highly weathered oils, perhaps from several sources, total hydrocarbon content of either sediments or animal tissues are not valid measures of stress imparted to *Mya arenaria*. Of all quantities determined, the estimated relative amounts of lower molecular weight hydrocarbons present in the tissues of *Mya arenaria* correlate most closely with reductions in carbon flux and hence, stress imparted to the clams. In the situation studied, the estimated concentrations of low molecular weight aromatic hydrocarbons in the clam tissues were small. This leads to the conclusion that low concentrations of low molecular weight aromatic hydrocarbons in clam tissues can cause large reductions in carbon flux.

The fact that both the leaching index and the carbon flux values required similar changes in the ranking of the sites when the total information was compiled is further evidence of an interconnection between these two measurements. It would appear, therefore, that based on a significant correlation coefficient that a potential relationship between the soft shell clam carbon flux and hydrocarbon concentrations of moderately "low molecular weight residues" in the sediments exists. Future studies of the effects of these oil residue fractions would seem warranted. The carbon flux data appear to indicate that the soft shell clam is exceedingly sensitive to certain components contained in these oil fractions. Samples from Fort Williams and Willard Beach were analyzed and indicated that the surface sediments of these two exposed beach locations appear to have reached a relatively constant background level within three to eight weeks of the original spill. The data suggests that rather rapid dissipation of #6 oil will occur in exposed locations in Casco Bay provided that deep penetration of the sediments does not occur and that asphalt pavement formation did not take place. It would appear that, except for the most heavily oiled and sheltered intertidal zones in which deep penetration of the sediments had occurred, the dissipation of the Tamano spill in Casco Bay would be essentially complete during the fourth or fifth year.

INTERAGENCY AGREEMENT NO. AA550-IA7-09

TITLE: An Environmental Study of Possible Impacts of the ARGO MERCHANT Oil Spill

DATE: November 1977 - November 1978

COST: $170,000

PRIME CONTRACTOR:
National Oceanic and Atmospheric Administration (NOAA)

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
- U.S. Coast Guard
- Environmental Protection Agency
- Langley Research Center
- Wallops Flight Center
- U.S. Geological Survey
- U.S. Navy
- Division of Fisheries and Game (Massachusetts)
- Manomet Bird Observatory
- Marine Biological Laboratory
- University of Rhode Island
- University of Southern California
- Massachusetts Institute of Technology
- Woods Hole Oceanographic Institution
- Aero-Marine Services, Inc.
- Development Sciences, Inc.
- Discover Flying
- EG&G Environmental Consultants
- New England Air-Photo Association
- Raytheon

PROGRAM MANAGER:
John Robinson

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Robert Beauchamp

OBJECTIVES:
The objective of this study was to contribute funds to a NOAA-managed study on the environmental impacts, and assessment of the ARGO MERCHANT oil spill.

FINAL REPORT:

The ARGO MERCHANT Oil Spill, a Preliminary Scientific Report (NOAA Special Report, March 1977) (P. L. Grose, J. S. Mattson, editors, 1977)

AVAILABILITY:

Superintendent of Documents
U. S. Government Printing Office
Washington, D. C. 20402

SUMMARY:

This report documents the cooperative investigations that were undertaken immediately following the grounding of the Argo Merchant on Nantucket Shoals on December 15, 1976. It describes completed and continuing research on the physical, chemical, and biological processes associated with the spill, and provides a preliminary assessment of the spill as of March 1977. Neither the chemical nor biological studies were fully completed at the time of publication, as this was only a preliminary report. With this in mind the following preliminary results were presented.

- °The oil from the Argo Merchant stayed on the ocean surface, with the exception of the "cutter stock," which entered the water column, and an as-yet undetermined amount of whole oil that was mechanically worked into the bottom in the immediate vicinity of the wreckage.
- °Oil in significant amounts had not been found in the sediments, except within 10 miles of the bow section of the Argo Merchant, where concentrations up to 100 parts per million were measured.
- °Modeling efforts were successful in predicting the offshore movement of the surface oil, primarily because the movement was controlled by predominantly offshore winds while the complicated circulation of the nearshore areas and Nantucket Shoals played only a minor role.
- °There was evidence of oil contamination in fish, shellfish, ichthyoplankton, and zooplankton populations in the area of the spill. Of the seabirds affected by the surface oil, the highest mortality was observed among Murres.
- °The No. 6 fuel oil from the Argo Merchant formed pancakes of oil that tended to increase in thickness as they aged. These pancakes were observed to have flat bottoms, and they did not appear to be tapered towards their edges. The affected surface area was not solidly covered by a continuous film of oil but rather by thick pancakes, very thin oil film (sheen), and large open areas of water. Several direct measurements of the velocity of the oil pancakes relative to the surface water indicated that this differential velocity was about one percent of the wind speed in a downwind direction. The oil sheen appeared to be generated by the oil in the pancakes and moved at a slightly lower speed.

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MULTIREGIONAL & NATIONAL STUDIES

Endangered Species

BLM CONTRACT NO.AA551-CT8-48/MMS CONTRACT NO. 14-12-0001-29163

TITLE: Characterization of Marine Mammals and Turtles in the North and Mid-Atlantic Areas of the U.S. Continental Shelf

DATE: 29 September 1978 - 15 March 1983

COST:	FY 78; $1,454,791
	FY 80; $ 803,959
	FY 81; $ 941,986
	$3,200,736

PRIME CONTRACTOR:
University of Rhode Island
Graduate School of Oceanography (GSO)
Kingston, Rhode Island 02881

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
- Aero-Marine Surveys, Inc (AMS)
- College of the Atlantic (CA)
- Environmental Research Laboratories (ERL)
- Marine Science Consortium (MSC)
- Ocean Services, Inc. (OSI)
- Provincetown Center for Coastal Studies (PCCS)
- University of Maine (UM)
- University of Rhode Island--Zoology Department (URI)

CHARTERED RESEARCH VESSELS:
- R/V Tioga
- M/V Dolphin III

PROGRAM MANAGER:
- Richard Edel
- Martin Hyman

PRINCIPAL PARTICIPANTS:
- Nancy Bray, Turtle Assessment, Y1 (URI)
- Thomas Doty, Turtle Assessment Y2-3 (URI)
- Timothy Flynn, Aerial Services (AMS)
- James Gilbert, Consultant (UM)
- James Hain, Cetacean Assessment (GSO)
- Herbert Hays, Cetacean Assessment (MSC)
- Steven Katona, Consultant (CA)
- Robert Kenney, Cetacean Assessment (GSO)
- Connie Knapp, Data Coordinator, Y1 (GSO)
- Charles Mayo, Consultant (PCCS)
- Harold Peterson, Jr., Data Consultant (ERL)
- Richard Rowlett, Consultant (MSC)
- Gerald Scott, Cetacean Assessment (GSO)

C. Robert Shoop, Turtle Assessment (URI)
William Steiner, Cetacean Assessment (GSO)
Marlene Tyrell, Data Coordinator, Y2-3 (GSO)
Howard Winn, Scientific Director (GSO)

CONTRACTING OFFICER:
Robert J. O'Connell
Jeffrey P. Petrino

COR: Eiji Imamura

OBJECTIVES:
The program's objectives were as follows:

1. Determine which species of marine mammals and marine turtles inhabit and/or migrate through the study area.

2. Identify, delineate and describe areas of importance (feeding, breeding, calving, etc.) to marine mammals and marine turtles in the study area.

3. Determine the temporal and spatial distribution of marine mammals and marine turtles in the study area.

4. Estimate the size of and extent of marine mammal and marine turtle populations in the study area.

5. Emphasize the above items 1-4 for those species classified as threatened or endangered by the Department of Interior and Department of Commerce.

FINAL REPORT:
A Characterization of Marine Mammals and Turtles in the North and Mid-Atlantic Areas of the U.S. Outer Continental Shelf (1981) -- First Year (CeTAP, 1981)

AVAILABILITY:
Available from NTIS: Final Report - PB81243289
Executive Summary - PB81243271

SUMMARY:

The final report presents the results of the initial 14 months of field studies from the Cetacean and Turtle Assessment Program (CETAP). It provides information on the temporal and spatial distribution of the 21 species of cetaceans reported from the study area for the period November 1978 to January 1980 (fig. 23). Areas of importance (feeding, breeding, and calving) are identified where possible, as are movements and migration routes. The study area is defined as the continental shelf waters of the northeastern United States, between the coast line and five nautical miles seaward of the 1,000-fathom isobath, and from Cape Hatteras, North Carolina, northward to Cape Sable, Nova Scotia.

The 21 species of cetaceans were divided into two groups, large whales (7 species) and small whales (14 species). The most commonly sighted large whale was Balaeonoptera physalus, fin whales, consisting of 47 percent of the large whale sightings and were uniformly and widely spread over the entire continental shelf from North Carolina to West Quoddy head, Maine. Megapteria novaeangliae, humpback whales, comprised 27 percent of the large whales sightings. The minke whale, Balaenoptera acutorostrata, made up 10 percent of the large whale sightings, and were in a similar habitat as B. physalus. Physeter catodon, sperm whale, was 9 percent of the large whale sightings and was closely associated with the shelf edge and beyond. The right whale, Eubalaena glacialis, was spotted in 8 percent of the large whale sightings and the area within a 100 mile radius of Cape Cod appears to be an important area. The two least common large whales were Balaenoptera borealis, (sei whale) and Orcinus orca (killer whale).

Among the small whales, Tursiops truncatus, bottlenose dolphin, was the most commonly seen, 30 percent of small whale sightings, and were frequently seen with pilot whales, Globicephala spp. The pilot whale, Globicephala spp., was seen in 17 percent of the sightings and was commonly and widely distributed. The Atlantic white-sided dolphin, Lagenorhynchus actus made up 12 percent of the small whale sightings. The harbor porpoise, Phocoena phocoena, 12 percent of the sightings, was almost entirely limited to the continental shelf waters of New England, in an area from southeast of Nantucket, northeastward across most of Georges Bank, and thoughout the Gulf of Maine. Grampus griseus, Grampus or Risso's dolphin, 11 percent of sightings, appeared to be concentrated on the continental shelf from south of Nantucket to south of Cape Henry, Virginia. Delphinus delphis, common or saddleback dolphin, 10 percent of the sightings, was widely distributed on the shelf edge. Stenella spp., spotted dolphins, made up 4 percent of the sightings and were concentrated east of Chesapeake Bay south along the shelf edge to Cape Hatteras, NC. The striped dolphin, Stenella coeruleoalba, 4 percent of the sightings, was seen along the edge of the shelf east of Delmarva Peninsula. Among the uncommon sightings were: Lagenorhynchus albirostris (white beaked dolphin), Ziphius cavirostris (Cuvier's beaked whale), Stenella longirostris (long-snouted or spinner dolphin), Steno bredanensis (rough-toothed dolphin), Delphinapterus leucas (Beluga), and Mesoplodon (beaked whales).

FINAL REPORT:

A Characterization of Marine Mammals and Turtles in the Mid- and North Atlantic Areas of the U.S. Outer Continental Shelf (1982) -- Second Year (CeTAP; Winn, ed., 1982)

AVAILIBILITY:

Available from NTIS; Final Report - PB83149906

SUMMARY:

The 1980 CETAP Annual report contains the interpretations and syntheses of marine mammal and turtle data collected during the program's second year field effort between 10 January 1980 and 22 January 1981. There were no new species which had not been previously sighted in the 1979 surveys.

There were some changes or differences from the previous year's sightings:

1) increased sightings of sei whales (B. borealis)
2) increased sightings of beaked whales (Z. cavirostris and Mesoplodon spp.)
3) decreased sightings of spotted dolphins (Stenella, spp.) and striped dolphins (S. coeruleoalba)
4) more southerly sightings of harbor porpoise (P. plocoena).

The most common turtle seen was the loggerhead (Caretta caretta).

The sightings were in three groups: large whales, small whales, and turtles. In the large whale group, seven species were sighted: (1) Balaenoptera physalus, fin whale, 51.3 percent, (2) Megaptera novaeangliae, humpback whale, 19.2 percent, (3) Balaenoptera acutorostrata, minke whale, 9.7 percent, (4) Physeter catodon, sperm whale, 8.2 percent, (5) Eubalaena glacialis, right whale, 7.3 percent, (6) Balaenoptera borealis, sei whale and (7) Balaenoptera musculus, blue whale. In the small whale group, 14 species were sighted (1) Tursiops truncatus, bottlenose dolphin, 23 percent, (2) Phocena phocena, harbor porpoise, 19 percent, (3) Lagenorhynchus acutus, white sided dolphin, 15 percent, (4) Globicephala spp, pilot whale, 13 percent, (5) Grampus griseus, Grampus or Risso's dolphin, 12 percent, (6) Dephinus delphis, common or saddleback dolphin, 11 percent, (7) Stenella spp., spotted dolphins, 2 percent, (8) Stenella coeruleoalba, striped dolphin, 2 percent, (9) Mesoplodon spp., beaked whales, 1 percent, (10) Lagenorhynchus albirostris, white beaked dolphin, (11) Delphinapterus leucas, beluga whale, (12) Hyperoodon ampullatus, northern bottlenose whale, (13) Ziphius cavirostris, goosebeaked or Cuvier's beaked whale and (14) Orcinus ocra, killer whale. In the turtle group, four turtle species were sighted: (1) Caretta caretta, loggerhead sea turtle, 96 percent, (2) Dermochelys coriacea, leatherback sea turtle, (3) Chelonia mydas, green sea turtle, and (4) Lepidochelys kempi, Kemp's ridley turtle.

FINAL REPORT:

A Characterization
of Marine Mammals and Turtles in the Midand North Atlantic
Areas of the U.S. Outer Continental Shelf
(1982) -- Third Year (CeTAP, 1982)

AVAILABILITY:

Available from NTIS: Final Report - PB83215855

SUMMARY:

The third and final year of CETAP studies took place in 1981. Much of the methodology described in the 1979 and 1980 CETAP Annual Reports was continued. However, there were a number of refinements and changes. In 1981, there were four principal changes to the field studies program and corresponding data collection: 1) the shipboard platforms-of-opportunity program was discontinued at the end of 1980; 2) the sampling within the study areas was largely restricted to lease sale areas and areas of known endangered species abundance; 3) a set of replicate samples was taken in order to gauge the variability present in abundance estimation based on aerial survey data; and 4) two additional survey blocks were added (one in the Mid-Atlantic, and one in the North Atlantic) over the continental slope and rise. The resulting data collection in 1981 were from: 1) four dedicated aerial surveys (including sampling); 2) three endangered species surveys; 3) an aircraft-of-opportunity program; 4) a dedicated cruise studying respiration and dive time behavior in the Cape Cod area; and 5) opportunistic data contributed by a number of sources. This CETAP Final Report presents the cumulative and summarized results from field studies which began in November 1978 and concluded in January 1982.

During the 39 months of CETAP field studies, 26 distinct species or species groupings of cetaceans and 4 species of marine turtles were sighted in or nearby the study area.

The cetacean sighting data consisted of 11,156 sightings of 170,012 individuals of 26 species. Of the large whales, fin whales (B. physalus) and humpback whales (M. novaeangliae) were the more common species. Of the small whales, the bottlenosed dolphin (T. truncatus), harbor porpoise (P. phocena), whitesided dolphin (L. actust), pilot whales (Blobicephala spp.), grampus (G. griseus), and the saddleback dolphin (D. delphis) were the most common. The CETAP results included important new findings on endangered species, among them the right whale (E. glacialis) and the sei whale (B. borealis), and gave unique, and often the only live-sighting data on several uncommon or rare species, beaked whales for example (Z. cavirostris and Mesoplodon spp.).

Throughout the field studies, not all cetacean sightings were identifiable to species. Of the total sightings, approximately 23 percent were not identified to the species level. This percentage was made up of 998 sightings of large whales (1743 individuals) and 1520 sightings of small whales (48,180 individuals). Therefore, the species accounts represent 77 percent of the total cetacean sightings. Given the behavior of the animals, the interplay of weather and sighting conditions, and the inherent nature of biological sampling, these results are neither unexpected nor atypical.

Over the course of the CETAP field studies, 2820 sightings totalling 3180 individuals of 4 species of marine turtles were recorded.

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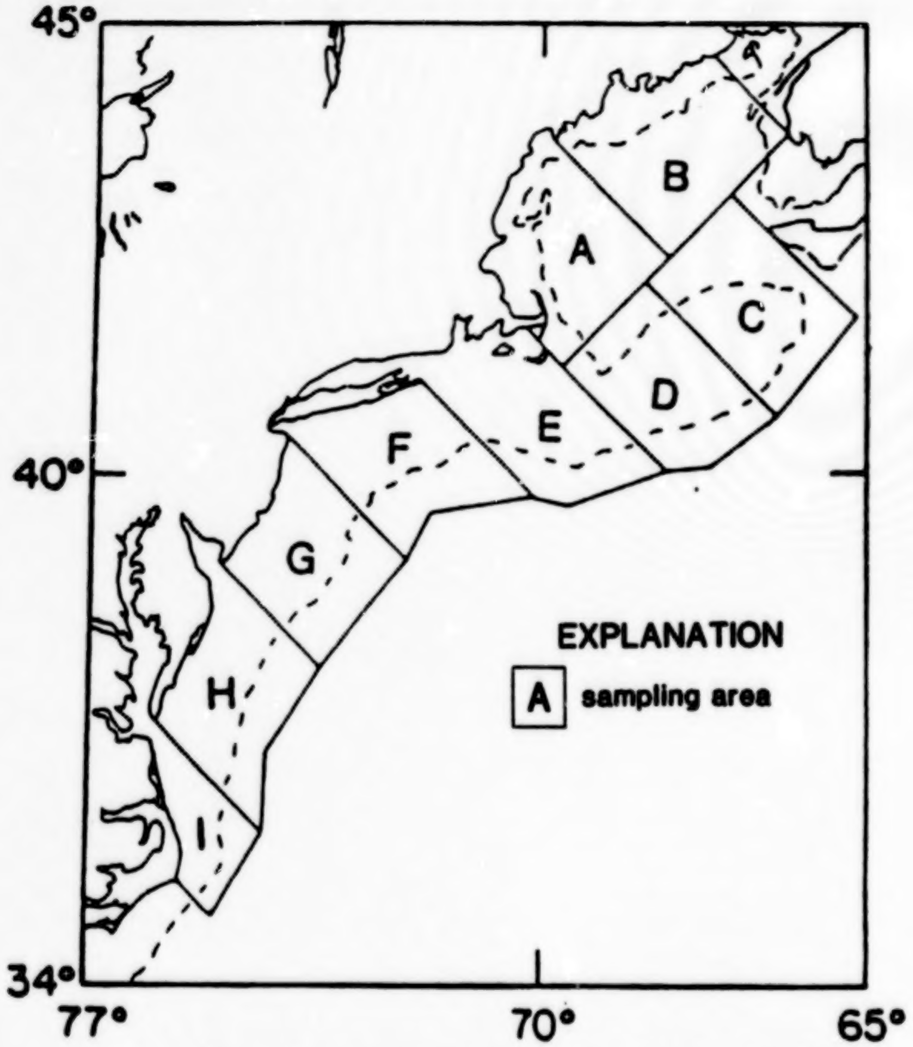

Figure 23. The study area for the CETAP program (CT8-48) from Cape Hatteras, North Carolina, to Nova Scotia, Canada, and from the coastline to the surface projection of the 2,000 meter depth contour.

BLM CONTRACT NO. AA551-CT9-29/MMS CONTRACT NO. 14-12-0001-29169

TITLE: Study of the Effects of Oil on Marine Mammals

DATE: September 1982 - February 1985

COST: $2,018,457 (Estimated)

PRIME CONTRACTOR:
University of Guelph
Ontario Veterinary College
Guelph, Ontario NIG 2W1 Canada

SUBCONTRACTOR:
Institute for Delphinid Research (IDR)

PROGRAM MANAGER:
David J. St. Aubin

PRINCIPAL PARTICIPANTS:
Joseph R. Geraci (Scientific Director)
A. J. Souccar
M. McLean
R. Reisman (IDR)

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: Neville Chow
Alyce T. Fritz

OBJECTIVES

First year program objectives were as follows:

1. Determine the ability of cetaceans to detect and avoid an oil slick.
2. Determine the effects of oil on the integument, and the ocular, respiratory, reproductive, digestive, and excretory systems of cetaceans.
3. Evaluate the long-term impact of the above effects on cetacean survival and behavior.
4. Analyze the potential for bioaccumulation of petroleum hydrocarbons and where practical, determine the toxic threshold levels for mammalian species.
5. Identify a range of mitigating measures which would eliminate or minimize the effects of oil pollution on marine mammals.

FINAL REPORT:

Effects of Oil on Cetaceans (J. R. Geraci, D. St. Aubin; 1982)

AVAILABILITY:

Available from NTIS:
Final Report - PB83152991

SUMMARY:

Study results indicate if a spill of crude oil occurs in a region where cetaceans are feeding and interacting, some animals may be killed - those trapped in a lead or enclosed bay, or moribund from disease. For most of the animals, however, the spill would probably not pose the kind of threat that has been popularized in the media.

It has been found that Tursiops, as a representative odontocete, can detect oil, and is inclined to avoid it especially after contact. Any brief encounter with oil may result in mild irritation to mucous membranes of the eyes, but there is no consequential effect on the few morphological and biochemical features of the skin thus far examined. A dolphin or whale, anywhere except in the heart of a fresh spill, could not inhale enough vapor or ingest enough oil to pose any immediate threat. There may be long-term consequences that are as yet undefined. These will only become apparent by monitoring animals in a perpetually contaminated environment, and by more penetrating studies into typical target sites of petroleum damage.

The behavior of mysticetes toward the oil spill is not as clear because the studies were limited to brief field observations on a single species. However, their reaction to contact with oil is expected to be similar to that of odontocetes. In contrast to toothed whales, the threat to baleen whales would not necessarily diminish with time after the spill. Residual products, tar, and weathered oils can potentially foul plates in a way that interferes with feeding. In most cases, the major effects are reversible within a few days, before affecting the animals' nutritional status. However, prolonged impairment caused by repeated fouling might diminish blubber stores, which would be essential during migration and other periods of fasting. Such latent effects would only be detected by correlating physical condition with petroleum residues and metabolites in animals available through commercial and aboriginal whaling operations.

OBJECTIVES:

Specific objectives of the Second Year Study are as follows:

1. Determine the ability of cetaceans to detect hydrocarbons representing an oil spill under nocturnal conditons, and specifically identify the cause of the avoidance reaction (tactile vs. visual) demonstrated in the first year experiments.

2. Determine the effects of oil on the filtering efficiency and structural integrity of baleen (at a minimum, bowhead, humpback, and right whales).

3. Characterize the quantity of hydrocarbons and their derivatives in marine mammal tissue.

4. Determine the extent to which delipidation occurs in cetacean skin after exposure to hydrocarbons and to determine delipidization effects on cetaceans.

5. Examine the tissue reponse of cetacean skin to implanted miniature "radio-tags."

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BLM INTERAGENCY AGREEMENT NO. AA851-IA0-5/MMS INTERAGENCY AGREEMENT NO. 14-12-0001-29172

TITLE: Study of the Effects of Sound on Marine Mammals

DATE: 11 January 1980 - September 1982

COST: $393,600

PRIME CONTRACTOR:
U.S. Navy
Naval Ocean Systems Center (NOSC)
San Diego, CA 92152

PROGRAM MANAGER:
Elek Linder

PRINCIPAL PARTICIPANTS:
Robert S. Gales
John A. Hoke
Elek Lindner
Donald K. Ljungblad
David R. Schmidt
Frank S. Shipp
Paul O. Thompson
Charles W. Turl

CONTRACTING OFFICER:
Jeffrey P. Petrino

COR: J. Philip Thomas
Eiji Imamura

OBJECTIVES:
The Naval Ocean Systems Center conducted field studies in areas off the Alaska, California, Gulf of Mexico, and Atlantic coasts. The objectives of this study were to:

1. Determine and characterize the various sounds emitted from outer continental shelf (OCS) oil and gas operations (exploration, development, and from related vessel traffic).

2. Characterize the sounds emitted and perceived by various species of cetaceans.

3. Evaluate the sound spectra created by human activities which could disrupt the behavior of cetaceans.

4. Determine the effects of a physical structure, such as a platform, on cetacean behavior.

5. Propose a range of measures for eliminating or alleviating the impact(s) of sounds and physical structures from offshore oil and gas operations on cetaceans.

FINAL REPORT:

Effects of Noise of Offshore Oil and Gas Operations on Marine Mammals - An Introductory Assessment. Naval Ocean Systems Center Technical Report 844, September (R. S. Gales, 1982)

AVAILABILITY:

Available from NTIS:
Final Report (Vol. I) -ADA123699
Final Report (Vol. II) -ADA123700

SUMMARY:

The effects of noise from offshore oil and gas operations on marine mammals were assessed by a multifaceted study. The literature was surveyed for available data on noise from oil platforms and on hearing capabilities of marine mammals. Data on animal behavior around the platforms were collected by field observations and interviews with platform personnel. The noise from platforms was measured at various geographic locations and analyzed in the laboratory. Evaluation of the combined data indicates that certain platforms are relatively quiet, and therefore platforms with minimal sound emission can be designed. The highest level components of the noise from oil platforms are below 100 Hz. The distances at which large whales can detect such noise were estimated for various geographical locations. It is unlikely that platform noise will interfere with echolocation of marine mammals, and according to anecdotal information, whales ignore or easily avoid the platforms.

MMS CONTRACT NO. 14-12-0001-30063

TITLE: Study of the Effects of Oil on Marine Turtles

DATE: 30 September 1983 - October 1985

COST: $552,135

PRIME CONTRACTOR:
Florida Institute of Oceanography (FIO)
830 First Street South
St. Petersburg, Florida 33712

SUBCONTRACTORS/COOPERATING INSTITUTIONS:
Florida Department of Natural Resources (DNR)
Shark Institute Sea World (SI)
University of Central Florida (UCF)
University of Miami (UM)
University of South Florida (USF)
Wildlife Veterinary Center (WVC)

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OBJECTIVES:
The study will conduct a preliminary literature review. Experiments will include behavioral responses of turtles to oil slicks and tarballs, effects of exposure to oil (ingestion and surface contact), and clinical examination of stranded marine turtles. All experiments will be supported by a detailed hydrocarbon analytical and dosing effort. Program objectives are to:

1. Determine the ability of marine turtles to detect and avoid or be attracted to tarballs and/or oil slicks.

2. Determine the effects of oil on the integument and the various physiological systems of marine turtles.

3. Evaluate the long-term impact of the above effects on marine turtle survival and behavior and analyze the potential for bioaccumulation of petroleum hydrocarbons and metabolites in marine turtles.

4. Predict--considering the known life history of sea turtles, records of past oil spills, and known climatic conditions--the possible impacts of oil on turtle nesting sites and on hatchlings, juveniles, and adults in an oil contaminated nearshore and open environment.

5. Identify a range of mitigating measures which would eliminate or minimize the effects of oil contamination on marine turtles.

FINAL REPORT:

Due 1 October 1985

AVAILABILITY:

To be submitted to NTIS

SUMMARY:

OTHER PUBLICATIONS/REPORTS:

Lutcavage, M., P. L. Lutz, and D. K. Odell, 1984. Study of the Effects of Oil on Marine Turtles - Revised Literature survey and Synthesis. Unpublished Report submitted to the MMS, 32 p.

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Appendix A

CHRONOLOGICAL LISTING OF CONTRACTS MANAGED BY THE ATLANTIC REGION ENVIRONMENTAL STUDIES SECTION

CT3-8	Socioeconomic and Environmental Inventory of the North Atlantic Region from Sandy Hook, New Jersey, to the Bay of Fundy
EQ4AC007	South Atlantic Socioeconomic Environmental Baseline Summary
CT5-11	Marine Environmental Implications of Offshore Oil and Gas Development in the Baltimore Canyon
CT5-12	Tamano Oil Spill Study
CT5-29	Georges Bank Conference - Marine Environmental Assessment
MU5-33	Mid-Atlantic Environmental Geologic Studies, Year 1
CT5-42	Environmental Data Acquisition and Analyses - Mid-Atlantic OCS (First Year Benchmark Study)
CT5-47	Continental Slope Environmental Information Summary - Canadian/U.S. Border to Cape Hatteras, N.C.
CT5-51	Tourism - Related Economic Data at the County Level
CT6-01	Evaluation of Regional Economics Effects of Offshore Oil and Gas Production in Mid-Atlantic OCS-Harris Model
IA6-3	Meteorological Buoy Monitoring Network/ South Atlantic Data Buoy
CT6-5	South Atlantic OCS Studies Conference
IA6-9	Preparation of EIS for Baltimore Canyon OCS
IA6-12	Mid-Atlantic Physical Oceanographic and Meteorological Study
CT6-25	Socioeconomic Model Run
MU6-29	North Atlantic Geological Studies, Year 1
CT6-45	A Summary and Analysis of Environmental Information on the Continental Shelf from the Bay of Fundy to Cape Hatteras
CT6-50	EG&G New England Physical Oceanography, Year 1
CT6-51	New England Outer Continental Shelf Environmental Benchmark Study
CT6-53	Raytheon New England Physical Oceanography, Year 1
MU6-56	South Atlantic OCS Geological Studies, Year 1
CT6-62	Second Year Benchmark Studies for the Middle Atlantic Region.
CT7-2	South Atlantic OCS Benchmark Study
IA7-9	Argo Merchant Oil Spill Study
CT7-16	South Atlantic OCS Physical Oceanography Literature Synthesis
CT7-29	South Atlantic OCS Physical Oceanography Field Study, Year 1
MU7-31	Mid-Atlantic Geologic Studies, Year 2
IA7-35	NMFS Middle Atlantic Biological Baseline Studies
CT7-39	South Atlantic OCS Literature Synthesis
MU8-13	South Atlantic OCS Geological Studies, Year 1
IA8-14	Georges Bank Climatological and Oceanographic Analysis
CT8-18	Summary and Analysis of Cultural Resource Information from the Bay of Fundy to Cape Hatteras
MU8-21	Mid-Atlantic Geologic Studies, Year 3
MU8-24	North Atlantic Geological Studies, Year 2

CT8-25	South Atlantic OCS Hard Bottom Study
CT8-32	Benthic Recolonization Study under Simulated Oil Spill Conditions in the Mid-Atlantic OCS Area
CT8-34	Physical Oceanographic Modeling for the South Atlantic - Evaluation Study
IA8-37	South Atlantic OCS Data Buoy, FY'78-81'
IA8-39	South Atlantic OCS Satellite Oceanography
CT8-40	South Atlantic Cultural Resources Evaluation Study
CT8-46	EG&G New England Physical Oceanography Year 2
CT8-47	Raytheon New England Physical Oceanography Year 2
CT8-48/29163	North and Mid-Atlantic Marine Mammals and Turtles Study (CeTAP)
CT8-49/29164	Canyon Assessment Study in the Mid- and North Atlantic Areas of the U.S. OCS
CT8-52/29138	South Atlantic OCS Physical Oceanography, Year 2
MU9-4	Environmental Geology Studies - North and Mid-Atlantic
CT9-5/29165	Study of Crude Oil on the American Lobster
MU9-8/29166	Marine Habitat Mapping and Pipeline Hazard Assessment
IA9-24/29012	South Atlantic OCS Physical Oceanography Data Collection
CT9-26/29167	Assessment of Space and Use Conflicts on the U.S. OCS between the Oil and Gas Industry and Commercial and Recreational Fisherman
CT9-27/29168	South Atlantic OCS Area Living Marine Resources Study, Year 1
CT9-29/29169	Study of the Effects of Oil on Marine Mammals
CT9-32/29170	Application of a Coastal Circulation Model to the South Atlantic Outer Continental Shelf
IA0-5/29172	The Effects of Sound on Marine Mammals
CT0-12/29173	South Atlantic OCS Physical Oceanographic Field Studies, Year 3
MU0-16/29175	Blake Plateau Hazards Mapping Study
MUO-18/29175	North and Mid-Atlantic Environmental Geologic Studies
CT0-35/29176	Blake Plateau Bottom and Mid-Water Current Study (30°N), Year 1
CT0-59/29178	Study of Physical and Biological Processes of Canyons and the Continental Slope in the North and Mid-Atlantic U.S. Outer Continental Shelf
CTO-75/29181	Assessing the Impacts of Oil Spills on a Commercial Fishery
IA1-15/29183	Hazards Mapping Study
IA1-17/29184	North and Mid-Atlantic Environmental Geologic Studies
CT1-18/29185	South Atlantic OCS Area Living Marine Resources Study, Year 2
CT1-25/29186	South Atlantic OCS Physical Oceanographic Field Studies, Year 4
CT1-33/29187	Blake Plateau Bottom and Mid-Water Current Study (36°N), Year 2
CT1-39/29188	Interpretation of Physical Oceanography of the Georges Bank

CT1-68/29189	North Carolina Fisheries and Environmental Data Search and Synthesis Study
CT1-69/29190	Analysis of Historical Benthic Infaunal Samples from Georges Bank
CT2-7/29192	Georges Bank Benthic Infauna Monitoring
IA2-18/29194	The Analysis of Trace Metals in Bottom Sediments - Georges Bank Monitoring Program
CT2-25	Environmental Impacts of Utilizing Pipeline Corridors in the Mid-Atlantic
IA2-26/29196	Atlantic Geological Studies
CT2-33/29198	Analysis of Hydrocarbons in Bottom Sediments and Analysis of Hydrocarbons and Trace Metals in Benthic Fauna - Georges Bank Monitoring Program
CT2-41/29199	Alternative Modes for Transporting OCS-Produced Oil and Natural Gas
CT2-47/29200	An Environmental Summary of the U.S. Atlantic Continental Slope and Rise
CT2-61/29201	Atlantic OCS Physical Oceanography Synthesis, Year 5
CT2-62/29202	Blake Plateau Current Measurements Study, Year 3
CT2-85/29203	South Atlantic Outer Continental Shelf Circulation Model, Phase III
30001	Analysis of Hydrocarbons in Bottom Sediments and Analysis of Hydrocarbons and Trace Metals in Benthic Fauna as a part of the Second and Third Years Georges Bank Monitoring Program
30025	The Georges Bank Monitoring Program: Analysis of Trace Metals in Bottom Sediments during the Second Year Monitoring Period
30063	Study of the Effects of Oil on Marine Turtles
30064	Studies of Biological Processes on the U.S. Atlantic Slope and Rise
30066	Study of Physical Processes on the U.S. Mid-Atlantic Continental Slope and Rise
30082	Florida Atlantic Coast Transport Study (FACTS)
30153	Georges Bank Monitoring Program: Analysis of Trace Metals in Bottom Sediment, Year 3
30180	North Atlantic Slope and Canyon Study
30195	Information Transfer Meeting
30197	Analysis of Trace Metals in Bottom Sediments in Support of Deep-Water Biological Processes Studies on the U.S. Continental Slope and Rise

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